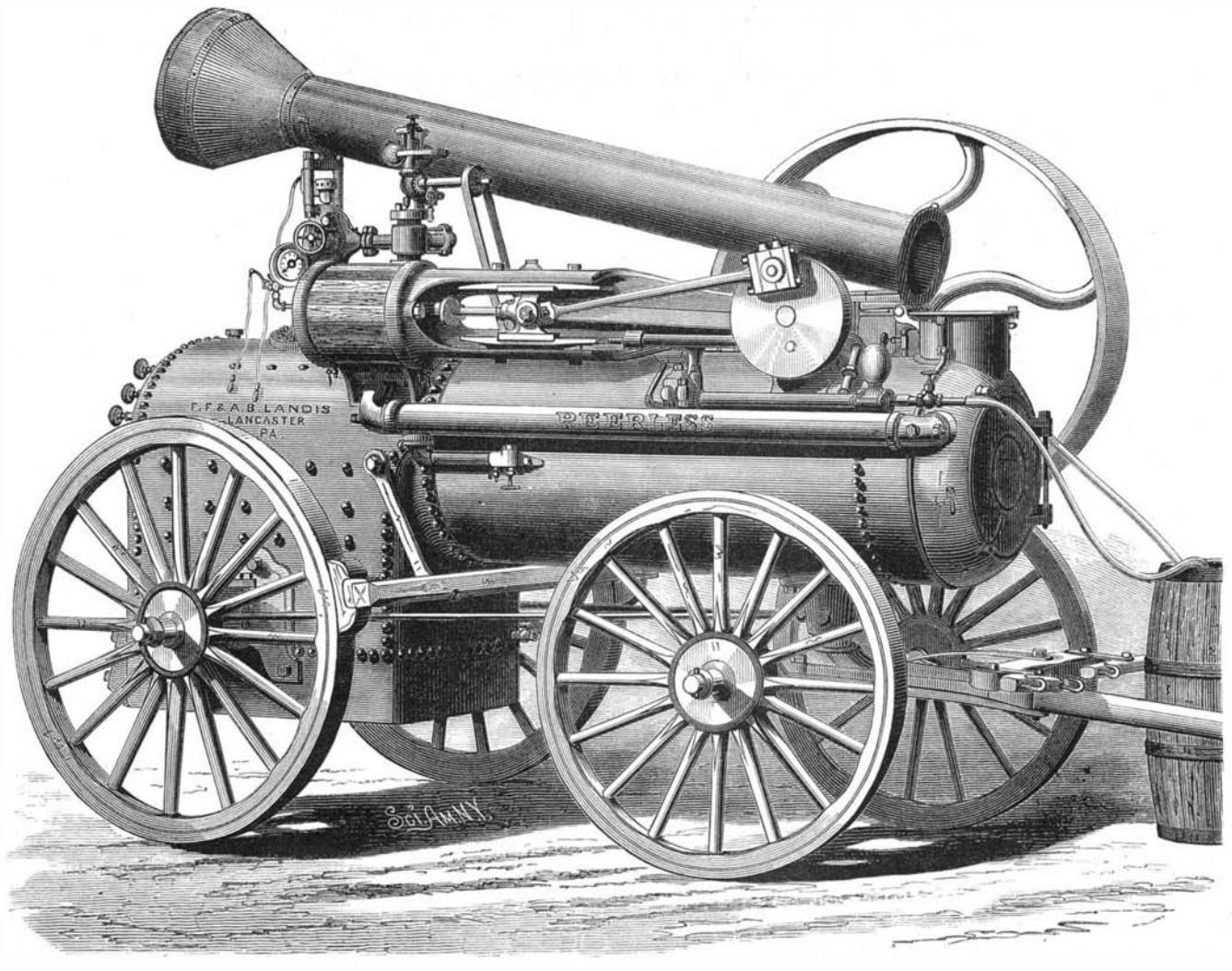
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVIII. No. 13. [NEW SERIES.] NEW YORK, MARCH 30, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

THE PEERLESS STEAM ENGINE.

We illustrate herewith a new portable steam engine, adapted to all cases where power ranging from 6 to 10 horse power is required. The new features relate mainly to the general construction, and are claimed to impart increased durability, efficiency, and economy in use. The engine is horizontal, and is balanced on the boiler by its fly wheel. The cylinder and steam chest are in one casting, and accurately aligned with the bed plate, and the latter is so constructed that nothing can get out of line. All parts are interchangeable. The guide bars are adjusted by underlaying them with paper. Hot bearings are avoided by passing cold water through a channel between bearings and boiler, keeping them cold, as in a stationary engine. When water is not required in the boiler, the flow is still maintained by opening a valve and allowing the water to return to the tank from which it was taken. This device is patented and owned exclusively by the manufacturers. The pump is thus kept continuously in operation and always ready to feed into the boiler. The eccentric is fastened to the crank wheel, and is made so that the engine can be reversed by simply loosening one nut and turning the engine in the desired direction for about one turn. The connecting rod bearings are large, and require very little adjusting. The crank and cross head pins are hardened and ground true by special machinery. The valve chambers and valves of the pump are made of composition metal, and are of easy access. In case it becomes necessary to remove dirt from them, by loosening one nut which holds a bar down on the caps over the valves everything can easily be taken out, even while the engine is in motion, the workman standing on the ground. The steam pipes are tightly put together with ball and socket joints, and are easily taken apart. The check valve is so constructed that in case of its becoming choked the opening of a jet cock, and raising the small wheel under it, cause the valve to be lifted from its seat and the obstruction blown out. Arrangements are made to prevent the engine being affected by boiler expansion. The boiler is of the best American plate, and provided with an improved fusible plug in the crown sheet. The whole apparatus is put on steel springs; the smoke stack is hinged, so that it can be laid back, and is provided with a spark arrester; the governor and safety valve are of improved construction, and generally the machine is, we are informed, well and substantially made. For further information address the manufacturers, Messrs. F.F. and A. B. Landis, Lancaster, Pa.



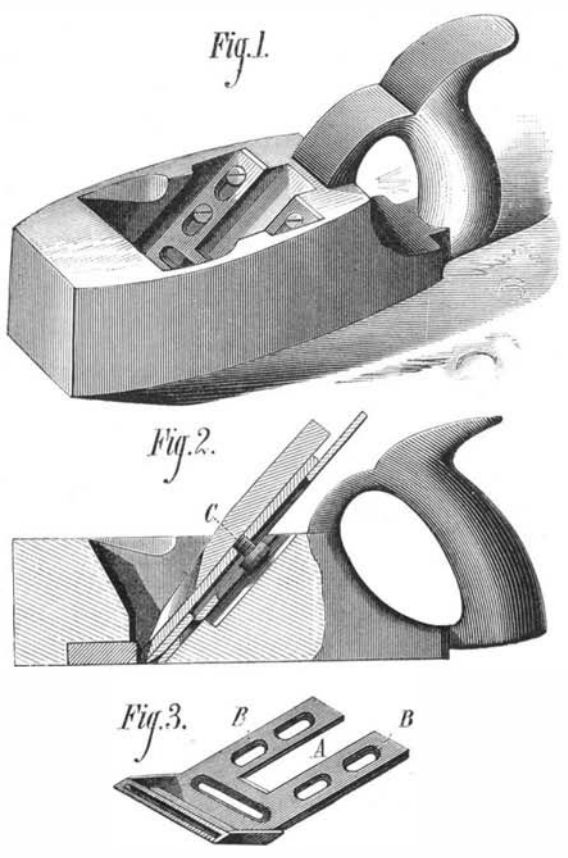
THE PEERLESS PORTABLE STEAM ENGINE.

New Telegraph Apparatus.

Experiments with a new telegraph apparatus have lately been made at Vienna, by means of which some one hundred or one hundred and twenty messages may be sent by a single wire in the remarkably short space of one hour. Under certain conditions this number may even be raised to two hundred or even two hundred and fifty messages. The inventor of the new apparatus is Herr August Eduard Granfeld, an Austrian telegraph official. At the end of December he presented to the Austrian "Telegraphenanstalt" eight working and two principal apparatus of his invention for practical trials. The experiments are reported to have been crowned with complete success.

IMPROVED BENCH PLANE.

The invention herewith illustrated is an improved adjustable metal lining for the throat and mouth of a bench plane,



BOYCE'S PLANE LINING.

the object being to protect the parts from wear. It is of simple construction, and may easily be applied to planes whether old or new. Fig. 1 is a perspective and Fig. 2 a sectional view of a plane with the lining in place. Fig. 3 shows the lining separate. It will be seen from the sectional view that the usual coupling set screw and wedge are employed. The lining plate has an open slot, A, two oblong countersunk slots, B, a central opening, and an oblong mouth, which consists of abutting sides and a transverse connecting strip. The bed of the plane is reduced to receive the lining, and the wood at the sides and front of the mouth is suitably mortised away. The plate is fastened to the bed by set screws, which pass through the slots, B. By means of these the readjustment of the plane face may be effected. The plane iron with its cap is placed upon the plate, and the coupling screw, C, is allowed to pass into the usual recess, which is in rear of the oblong opening of the lining. Thus applied, the iron and cap are fastened with the wedge. It will be readily seen that the device can be applied with great facility, and that its addition in nowise weakens the plane, but, on the contrary, the durability of the latter is materially increased.

Patented February 5, 1878. For further information address the manufacturers, Messrs. Boyce & Bruce, Box 1185, Lockport, N. Y.

Notes Given for Patent Rights.

Judge Sharswood filed the opinion of the Supreme Court, on Monday, in the case of Haskell *vs.* Jones. The case is one of a series pending in this State which involves the constitutionality of the act of Assembly, which makes it a misdemeanor to issue a promissory note given for a patent right without the words "Given for a patent right" written across its face. In this case the note was actually given for a patent right, but the words were not written across its face. The court decided that the note was nevertheless good.—*Harrisburg (Pa.) Telegraph, March* 6.

[We have several times called the attention of State legislators to the folly of enacting laws like the above, in the hope of regulating patents. All such State laws are invalid. Under the Constitution of the United States all legislation relating to patents is vested in Congress. Judge Sharswood's decision is in accordance with analogous decisions by the courts heretofore published in the SCIENTIFIC AMERICAN.]

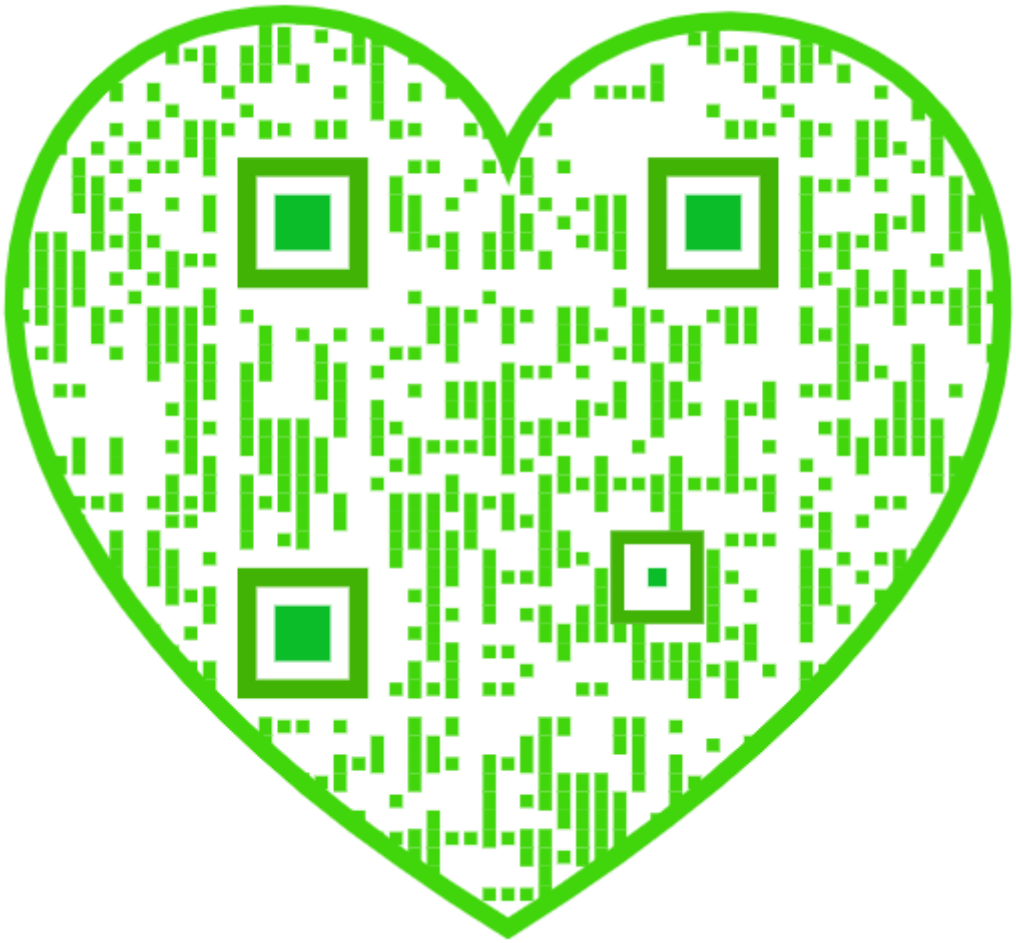
Imitation Ebony.

The following recipe, which we take from the *Revue Industrielle*, will answer numerous correspondents who have inquired how to turn oak black so as to cause it to resemble ebony. The wood is immersed for forty-eight hours in a hot saturated solution of alum, and then brushed over several times with a logwood decoction prepared as follows:

Boil 1 part of best logwood with 10 parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one half. To every quart of this add from 10 to 15 drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained.

Oak thus stained is said to be a close as well as handsome imitation of ebony.

© 1878 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... **$3 20**
One copy, six months, postage included **1 60**

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.

☞ Subscriptions received and single copies of either paper sold by all the news agents.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4 gold, for SCIENTIFIC AMERICAN 1 year; for both SCIENTIFIC AMERICAN and SUPPLEMENT, $9 gold for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

VOL. XXXVIII., No. 13. [NEW SERIES.] *Thirty-third Year.*

NEW YORK, SATURDAY, MARCH 30, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Æolian harp [42] 204
Amplifier, Tolles'. 202
Astronomical notes. 193
Astronomical photography..... 197
Bearings [36]..... 204
Brick machines..... 202
Business and personal... 203
Calendar 202
Cleopatra's needle*..... 199, 200
Color blindness [7]..... 203
Communications received..... 204
Correspondence..... 196
Cotton, Egyptian..... 197
Creosoting ties..... 201
Ebony, imitation..... 191
Electric light [2]..... 203
Explosions in mines..... 196
Explosive dust..... 200
Feed regulator*..... 198
Fish hatching..... 199
Gas engine, Otto*..... 195
Glass, explosion of toughened.. 199
Glue for wet wood [6]..... 203
Hardening small tools [31]..... 203
Harrow, Dobbin's*..... 199
Homeopathic insurance..... 200
Howgate expedition..... 192, 193
Insane, music for..... 200
Invention, encouraging..... 192
Inventions, agricultural... .. 197, 198
Inventions, mechanical..... 200, 201
Inventions, new..... 201
Jaw for lathe chucks*..... 194
Kerosene, dangerous..... 199
Limestone bearings..... 202
Locomotive stroke..... 196
Locomotive vs. steamer [26]. ... 203
Marine engine economy..... 194
Microscopical notes..... 195, 196
Minerals 204
Notes and queries 203, 204
Ocean phenomena 194
Patent decisions 202
Patent rights, notes for..... 191
Patents, English, to Americans.. 204
Patents, official list of..... 204
Petroleum, pure..... 198
Phonograph*..... 193
Plane, Boyce's*..... 191
Plant absorption..... 198
Plant mind..... 196, 197
Portable engine, Peerless*..... 191
Postal service 192
Roofing [40] 204
Saw mill dog*..... 198
Sea beans..... 201
Soda ash for boilers [29] 203
Steam engine formulæ [13]..... 203
Steel armor [46]... 204
Sugar machinery*..... 194
Telegraph apparatus, new..... 191
Telegraph relay [8]..... 203
Telephone [12] [20]..... 203
Telephone notes 194
Tree waste..... 193
Tricycle, improved*..... 201
Varnish for throttles [8]..... 203
Velocipede, power required..... 196
Ventilators, mica..... 195
Vessels, speed of [24] 203
Vinegar, testing [1] 203
Wild beast exterminators..... 197
Wrecks, Atlantic 194

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 117,
For the Week ending March 30, 1878.

Price 10 cents. To be had at this office and of all newsdealers.

I. ENGINEERING AND MECHANICS.—New Method of Balancing the Engines used in Winding from the Deep Shafts of Westphalia. By W. FAIRLEY. 3 illustrations.—New Gas Engine. 2 illustrations.
Improved Emery Grinder. 2 illustrations.
Compacted Beams. By THOMAS MORRIS. Strength of Wood vs. Iron. Fish and other Joints. Power of Screws, etc. 4 illustrations.—Improved Railway Axle Boxes. By H. W. WIDMARK. 4 illustrations.—Locomotive Economies.
Mining Notes: The Pulaski Tunnel. The Burleigh Tunnel, etc.—New Hand Power Rock Drill. 5 illustrations.—Heavy Mining Machinery.—Source of Water in Mines.—The Sutro Tunnel.
The New Brazilian Ironclad "Independencia." History of Her Construction. Armament, Rig, Turrets, and Engines. 2 illustrations.
The New Sailing Yacht Intrepid. Dimensions of Hull and Spars. Area of Canvas, Cabin Fittings, etc.
How to Build a Cheap Catamaran. Full dimensions, directions for construction, and four illustrations of a fast, handy Boat in actual use.—A New Catamaran.

II. TECHNOLOGY.—Description of the United States Mint, Philadelphia, Pa., and the method of Coining Money. The Receiving Room. Delicate Scales. The Melting Room; the Melt; the Assay. Assaying Gold. The Silver Assay. The Separating Room. The Losses. Rolling. The Dies. Coining Department. The New Dollar.
The Technology of the Paper Trade. Lecture IV. By WILLIAM ARNOT, F. C. S. Description of the Boilers. Charging and Working. Revolving and Stationary Boilers. The Sinclair Process. These lectures treat of every department of Paper Making; the various materials, as hemp, esparto, rags, wood, etc; beating, bleaching, boiling, sorting, and all other processes, with practical instructions, and descriptions of the best machines.
Ornamental Designs for Monument, with Wrought Iron Inclosure. 3 illustrations.
Petroleum Oil Gas for Lighting Passenger Cars.—The Bitumen of Judea Process.

III. CHEMISTRY AND METALLURGY.—Action of the Copper-Zinc Couple on Alkaline Oxy-salts. By Dr. GLADSTONE and Mr. TRIBE.—Manchester Literary and Philosophical Society. Decomposition of Water by Iron Pyrites.—New Method for the Determination of Boiling Points. By H. C. JONES.—Xylophilin.—How to Improve Alloys.—Analogy between Chemistry and Algebra.

IV. ELECTRICITY, LIGHT, HEAT, ETC.—Optical Properties of Glass.—The Society of Telegraph Engineers.—Electrical and Telephonic Experiments.—New Form of Telephone, 2 illustrations.—Improved Telegraph Inker, 1 illustration.—Color in Polarized Light, 2 figures.—Microscopical Adjunct, 2 illustrations.—Electric War Lights.—Telephone Experiments. The Many-eared Telephone.—Radiometer Experiments.—Ratio of Air Heats.

V. MEDICINE AND HYGIENE.—How to secure Good Health. The substance of a lecture by Dr. T. L. NICHOLS, describing his important dietetic experiments. The Economy and Healthfulness of Asceticism.—Bloodless Tracheotomy.—Cholera.—Internal Fat.—Diabetes.—Death of M. CLAUDE BERNARD.—Blue Bile.—The London Small-Pox Epidemic.—A Fatal Laundry.—Disinfecting in Dublin.—The Hot Water Treatment. Service of Dr. Frank H. Hamilton, Bellevue Hospital, New York.—The "Lord of Snakes."—Shortsightedness.

VI. NATURAL HISTORY, ETC.—Corsican Blackbirds.—Education of Insects.—Live Savages.—Mexican Antiquities.

VII. CHESS RECORD.—Francois Andre Danican Philidor, with his Blindfold Games.—Problem by A. Bayersdorfer.—Problem by J. Berger.—Chess in New York.—Solutions to Problems.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

IMPROVEMENTS IN THE POSTAL SERVICE.

A new bill providing for the better classification of mail matter and rates of postage thereon will soon be submitted to Congress. The general principles on which the measure is based are that the Government should encourage the dissemination of intelligence by providing for the convenient and cheap transmission of letters, newspapers, periodicals, and books; that by a system of registration as a condition of cheap transmission, objectionable publications may be kept out of the mails; that uniform conditions should be prescribed for the transmission of all useful publications; that the postmaster at the place of mailing shall determine what may be sent, and fix the postage rate; that the postage on the same general class of publications, irrespective of frequency of issue, should be uniform at all post offices, and whether for specimen copies or to regular subscribers.

The essential object is to secure uniformity, and thus to obviate the constantly varying regulations or interpretations of the present postal laws relative to newspapers and periodicals made by different officials. These, when involving discrimination as to the class of periodicals, are apt to be vexatious and rarely to meet with general acquiescence, while they leave room for doubt or error which may easily become oppressive to those whose business largely depends upon the mail service. At the same time, the law as it now stands presents many anomalies, as, for instance, the fact that a monthly weighing just over two ounces, published in any of the large free delivery cities, pays $240 postage per thousand subscriptions in the city where published, while but about $50 postage is charged on the same if sent to any other part of the country, with free delivery at all other letter carrier offices.

The bill before us seems well adapted to meet all difficulties. It provides that newspapers and other periodical publications shall be registered yearly, and that thereupon the same may be sent at a uniform rate of two cents per pound or fraction. The periodical must be regularly issued at stated intervals, designed for dissemination of public information, formed of printed paper sheets, and published from a known office.

THE BEST WAY TO ENCOURAGE INVENTION.

In every discussion of the question of invention and its relations to human well being, it is assumed as a fact indisputable that it is a good thing to encourage invention. After the worst has been said against the incessant changes incidental to the activity of inventors, the common sense of all civilized men assents to the assertion that, in the aggregate, the labors of our inventors have been enormously beneficial, and that there is no reason to suppose that the time will come when invention will cease to be beneficial. The only point of difference is in regard to the best means of furthering the good work.

On the one side are those who hold that the simplest, most direct, and honest method is to recognize the inventor's exclusive right to the products of his thought and labor, and to place such intellectual property, for a definite time at least, on the same legal footing that other sorts of property enjoy; and in proof that this system does produce the effect desired the friends of patent rights point to the inventive activity developed in this country under the working of such a system.

The objectors say no; the result observed is due to other causes. Necessity is the mother of invention. A race of inventors has sprung up in this country because they were needed. Human labor was scarce and high. A new country was to be conquered and brought under cultivation. Wide fields demanded rapid means of sowing and harvesting. A scanty population and distant markets demanded greater facilities for rapid transit. A high ideal of life demanded a thousand new elements of gratification; and to supply all these demands a thousand new machines and processes had to be invented.

To a great extent all this is true, and much more might be said in this direction; but there is in all this no proof that without the encouragement the patent laws afforded the most of the alleged demands for invention would have been met. Barring inventions and their results, the conditions of life in this country have been precisely paralleled in Northern Asia. Over a large part of Russian Asia the climate is similar to that of our Northern States, wherein inventors have been most prolific. Its vegetable productions are very like ours. Our familiar forest trees abound in its wooded regions, and its plains are not unlike our prairies. Its soil is as fertile as ours; its minerals abundant; and its recent conquerors have many of the characteristics of our own people. An American traveler styles the Cossack the Yankee of Asia. He is energetic, thrifty, ingenious, handy with tools, can turn his hand to anything, and is mentally as bright as the average Yankee. His necessities—natural necessities—have been as numerous as those of the Yankee pioneer. His inventions—where are they? He quickly adopts the railways, telegraphs, and other products of Western invention, but adds no new ones. Our inventors have revolutionized the industries, the commerce, the modes of living of the civilized world; the Cossack, under similar natural conditions, open to the same natural necessities, endowed with the same natural gifts, has conquered a magnificent country, but he lives much as his fathers lived, and his influence upon civilization is *nil*.

But the Cossack is of a different race, it may be objected. True enough; but invention is not a matter of race. Brought under American influences, the least intelligent of the least inventive race in the world, the Chinese coolies, become inventors, as our patent records show. "Ah!" our objector continues, "that is the point. The surrounding influences, of education, newspapers, and the rest, make all the difference here. The Cossack has had none of these; nor to so great an extent has the coolie at home."

Well, then, let us look at the Yankees of Europe—the Swiss. They are of our own race. They are a free people. They are energetic, thrifty, and, for the most part, intelligent. The facilities they offer their youth for industrial education and practical training in the arts and sciences have long been superior to ours; and the Swiss government long ago adopted the very means of anti-patent "encouragement" of invention that the opponents of patent rights expect so much from. The progress of the industrial arts has there been left to the natural laws of free trade and open competition, so-called; that is, the open piracy of the inventions of all nations. The Swiss have not allowed invention to be "hampered" by pre-existing claims. They have not allowed inventors' royalties to increase the cost of their manufactures. And the result is—unrestricted and unrivaled progress in the arts? Wide awake mechanics and clever inventors? That ought to be the result, if the anti-patent theorists are in the right; but such is not the result. As Professor Shaler has so pertinently observed: "Despite the remarkably advantageous position of Switzerland, the natural vigor and capacity of her people, and their admirable system of public education, there have been disadvantages in connection with this plundering system (of reserving the power of using all inventions without payment therefor) that give us another proof that, in the long run, honesty is the best policy. All the while that Switzerland has been trusting to outside training for every invention she has applied in her manufactories, she has failed to train her own people in inventiveness; the result is, that Switzerland, of all civilized countries, is the most backward in the adaptation of every skillful appliance in every part of her economic life."

The impolicy of their course has lately come home to them with alarming force. For centuries they have led the world in the art of watch making; yet to-day American watches as good as their best can be sold at their doors for less money than they can make them. "Our well developed mechanical imagination has so organized the labor and the machines used in this branch of manufacture, that the advantages derived therefrom outbalance the vast advantages of Swiss labor. Our labor is double or more, our taxes double or more, our interest about double that of Switzerland; we have no traditional skill; nevertheless inventiveness conquers them all. Yet the inventiveness used in this work is but a very small part of our vast store of this priceless product of imaginative labor that has been created for us by our patent system."

All the conditions favorable to invention, that can exist in any country in the absence of patent rights, have been at work in Switzerland; but the Swiss have failed to distinguish themselves as inventors. All the conditions favorable to successful competition with the manufactories of other countries, with the privilege of using without paying for them the inventions of all other nations, have not enabled the factories of Switzerland to maintain their original supremacy. They have fallen behind because their artisans, lacking the stimlus to invention which patent rights afford, have fallen behind their brothers in this and other countries. They do not improve themselves; they do not improve their means and methods as ours do; they are not so fertile in resources, inventive, creative. And however high their technical skill may be, they cannot compete with men who are ceaselessly improving themselves and their processes in the hope of reaping the rewards which patent rights, and patent rights easily obtainable, hold out before our artisans as incentives to invention.

There may possibly be better ways of encouraging the arts and sciences, but so far as human experience has gone the simple recognition of an inventor's right to his creations has proved most productive of good results.

A POPULAR PROJECT.

For many years the hope of finding a commercially useful northwest passage was enough to justify to the masses the cost and risk of polar exploration. Before that hope was dissipated the humane desire to find Sir John Franklin or the remnant of his lost crew kept public interest alive to the need if not the value of Arctic expeditions. Both these objects failing, there remained only the possibility of glory to be won, or some indefinite promise of advantage to science to be gained through polar observations. For the first the public cared little; for the second it was at best very doubtful whether the profit would justify the cost. And to the pertinent question, What is the use of spending more money and risking more lives in that direction? the advocates of Arctic explorations had little to answer that the unscientific could appreciate.

But now, thanks to weather warnings, a significant change has come over public feeling on this point. The most popular project in Congress and out, at this time, is Howgate's scheme for the scientific exploration of the regions about the North Pole. Committees of both Houses of Congress have made reports decidedly favoring the project, while prominent commercial and scientific men everywhere have expressed their approbation of the undertaking.

Formerly when scientific men insisted that polar observations might be helpful to the science of meteorology, the quick retort was, "What of that?" Meteorology was then

© 1878 SCIENTIFIC AMERICAN, INC

the science that showed the least promise of usefulness. The idea that it could ever be serviceable through weather forecasting had not been broached, or, if it had been timidly suggested, was received with derision. The very Scriptures pronounced against it. Wherefore, then, should human life and public treasure be sacrificed to no good purpose?

But once again in the history of science the incredible has come to pass. The seemingly useless has proved to be of the utmost value. Weather prophecy has risen almost to the dignity of a governmental bureau, and affairs of national importance—agriculture and commerce, social and political movements—are largely regulated with reference to the daily report of "probabilities." And as fast as men come to understand that Arctic observations are necessary for the perfection of our already enormously useful weather service, they cease to look upon Polar explorations as something akin to foolhardy venturesomeness or scientific folly. The advancement of meteorological science is now something that appeals to every man's everyday interests; and when the exponents of the science say that the great weather factory of the northern hemisphere may lie around the Pole, and that the causes of many of our most destructive storms may be there at work, the reply is, "Go and see, and good luck go with you. If you want money for the work, you shall have it." It is yet—though it may not always be—impossible to prevent disastrous storms; but the damage they do can be largely prevented through timely warning of their approach. And it is possible that Howgate's colonies may be converted into permanent international meteorological stations, reporting daily by telegraph, and so be enormously beneficial to commerce, agriculture, and other industries, even if they should utterly fail on the score of mere geographical exploration. At any rate the scheme meets the hearty approbation of all thoughtful people, and it is to be hoped that the proposed appropriation for its furtherance will be sufficiently liberal.

THE PHONOGRAPH.

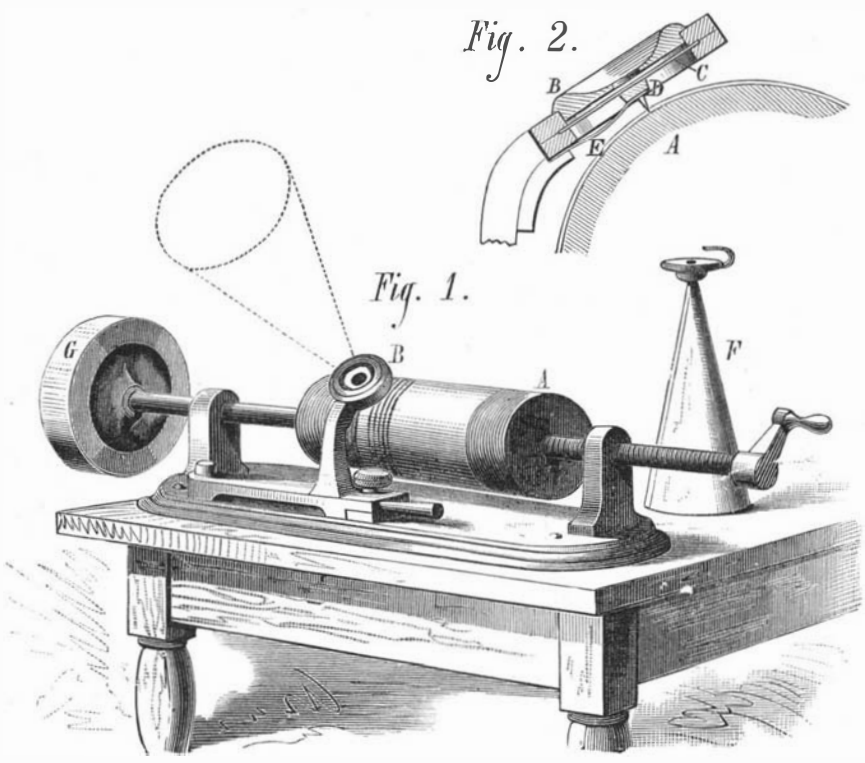
It is a peculiar feature of the Edison phonograph that no mere description can impart any really adequate idea of its performances. Fully familiar as we are and have been with the machine since its inception, it is still impossible for us to listen to it without a feeling of astonishment and a well defined doubt that our senses are not deceiving us. The extreme simplicity of the contrivance enhances this notion. There is nothing in the half articulated monotones of the complicated Faber apparatus to excite surprise, because, although illogically, the hearer half expects that such an assemblage of intricate mechanism will produce more startling results than it does; but here is really nothing but a revolving cylinder covered with a sheet of tinfoil, and a speaking tube; no levers, no springs, no keyboards, no artificial lips or larynx, no bellows. If we lived in 1678 instead of 1878 the life of Mr. Edison would not be worth a moment's purchase; in fact, he would have been resolved into carbonic acid, hydrogen, and his other constituent gases long ago in the flames set apart for earthly communers with his satanic majesty.

If accurate and clearly enunciated repetition of the sounds made in it is the *ultima Thule* of the phonograph's capabilities, then it has already attained that point. Where it is open to improvement, and to this the attention of the inventor is now being devoted, is in augmenting the intensity of the sound. In form it is substantially the same as when it was first described in these columns; that is, it consists, as plainly shown in our illustration, Fig. 1, of a brass spirally grooved cylinder, A, mounted on a long horizontal screw, the cylinder being rotated and at the same time moved laterally by turning a crank on the end of its axis. The chief modification is the abolition of the receiving membrane, one diaphragm, B, serving the double purpose of vibrating in response to the voice, and so indenting by the diamond tipped point, D, attached to the spring, E, the tinfoil wrapped about the cylinder, and also revibrating in response to the movements mechanically imparted to it by the indentations already made passing under the point. It is evident that this change must materially improve the reproductive power of the apparatus, because the size and nature of the membrane materially affect the vibrations it makes, and where two membranes are used a slight dissimilarity between them might result in considerable alteration in the sound emitted. Now, however, the same diaphragm revibrates, and the sound is modified perhaps as little as can be expected, the modification fortunately being in intensity and not materially in quality. The loss is manifestly due, first, to the inability of the rigid plate of metal, C, employed as a diaphragm to register the lateral vibrations which take place in direction parallel to its own plane; and second, in its vibrations being checked in amplitude by the friction met in overcoming the resistance of the foil, its own inertia, and in some degree probably the elasticity of the rubber pads in which it is held, as shown in the section, Fig. 2. Still a rigid plate seems to be a necessity, for it is doubtful whether a thin membrane, such as gold beaters' skin, while responding more fully to the sound waves, would support the point in making its indentations; that is, it is likely that it would yield itself before the tinfoil could be impressed deeply enough. This, therefore may be another subject for further investigation and possible improvement.

As it is, even now, the phonograph will meet the most sanguine anticipations of any one that hears it. The first model that was brought to our notice certainly talked, that is, it produced sounds, the *timbre* of which was unquestionably that of the human voice; but, as we said at the time, it required some previous knowledge to distinguish what was said. The speech was the lispings of infancy. At present previous explanation is wholly needless. The machine repeats the voice with perfect articulation and with every inflection, so that the tones may be recognized as those of the speaker who made them.

Through the courtesy of Mr. W. S. Applebaugh, who has charge of the apparatus now on exhibition in this city, we have been enabled to make as thorough an examination of all its peculiarities as we could desire. At our request the exhibitor sang into the machine an entire verse, and it was repeated as often as the cylinder was readjusted. Sounds of coughing, clearing the throat, knocks, noises of all kinds, were as accurately reproduced. A curious effect is produced by whistling, the apparatus giving forth every note clearly and fully; but more remarkable still is it to hear two voices at once come from the machine. The exhibitor first sang a verse which was registered, and then running the cylinder back talked so that the indentations produced by the speech vibrations came over those made by the song. The instrument repeated both utterances simultaneously, each, however, being clearly distinguishable. Another odd performance is turning the cylinder the wrong way, and making the machine talk the language backward.

The only means now used for magnifying the sound as it is emitted is the funnel-shaped resonator, F, attached to the speaking orifice. Mr. Edison, however, is busily experimenting upon some adaptation of compressed air, by which the sound waves, he thinks, may be intensified. He says that he can in time make the machine talk so loudly that it can be used on vessels to warn off other ships during fogs, and his last astonishing proposal is that he shall construct a huge phonograph to go in the great bronze statue of Liberty which is to be erected in New York Harbor, so that the metal giant can make a speech audible over the entire bay. In view of what Mr. Edison has already accomplished, his success in this respect would not surprise us.



THE PHONOGRAPH.

TREE WASTE AND ITS SEQUENCE.

The matter of forest tree culture and preservation is in rather an anomalous state in this country. At one end of the national domain, people are planting trees and studying every means to turn denuded lands back into forests; at the other, woods are being felled and a small war is in progress against the Government on account of its preventive efforts. In Massachusetts societies are organized to stimulate the preserving and renewing of forests; in Louisiana, Alabama, Florida, and Montana, the authorities are denounced as interfering with the best interests of the people, because an endeavor is made to stop the wholesale denuding of public lands and sale of the timber for private benefit. With the legal aspects of this question of forest destruction in the South and West, it is not our province to deal, but the considerations in favor of protecting woodlands are of importance not merely to every agriculturist, but to every one, and they should be fully realized by all who believe that the only value of forests lies in the amount the wood will fetch per cord.

If any one is disposed to think that our forests are inexhaustible, at least for a long period to come, he has only to cast his eye over the woodland map in General Walker's valuable statistical atlas to perceive his delusion. He will see that the number of heavily wooded tracts having 360 or more acres of timber to the square mile is startlingly small. The area of all such districts is equal only to about that of the Atlantic States, and the remainder of the country, fully four fifths, has no timber, the map showing a uniform blank. Now consider the enormous amount of lumber used yearly in manufactures. Nearly $144,000,000 is invested in the sawn lumber industry alone, that is, the production of laths, shingles, and boards. Add to this the fact stated by Professor Brewer that wood forms the fuel of two thirds of the population, and the partial fuel of nine tenths the remaining third, and some general idea of the enormous drain constantly in progress upon our forests will be reached. This, however, is only the direct draught for purposes of utility. Immense areas of woodland are yearly denuded by forest fires, large tracts are purposely burned as a speedy way of clearing, and thus the wooded regions are rendered more and more sparse. If forest fires were prevented as far as is practicable, if trees were constantly being planted, and if the reckless denudation of woodlands could be stopped by the laws already in existence, but apparently not enforced, there is little doubt but that we possess timber enough to supply indefinitely all our needs either as fuel or for manufacturing purposes; but save in isolated instances trees are not being planted, we have no schools of forestry such as exist in Europe to encourage sylviculture, and as the recent proceedings in Congress have shown, a part of the population claims the right for private ends to denude the woodlands now owned by the whole country, and defenders in the Legislature are not wanting to support them.

We have already taken occasion to point out the dangers which result from tree destruction. The exact relation of forests and rainfall is not definitely settled; but there are very numerous cases on record where the destruction of forests has resulted in the production of desert wastes, and where trees have been replanted humidity has returned. It is laid down, however, by such authorities as Dr. J. Croumbie Brown, of Scotland, and others who have made especial studies of the subject, that "within their own limits and near their own borders forests maintain a more uniform degree of humidity in the atmosphere than is observed in cleared grounds. They tend to promote the frequency of showers, and if they do not augment the amount of precipitation they probably equalize its distribution through the different seasons." "In India," says Mr. B. G. Northrop, in a late address before the Connecticut State Board of Agriculture, "three quarters of a million people have been starved to death since the forests have been cut off, causing the springs to dry up."

It is needless to multiply warnings of this kind. In the thickly settled countries of Europe each generation is bound by law to leave the forests in as good condition as it found them. Forests are protected from fire and they are regarded as public property. Until we adopt some similar course, each succeeding generation will transmit to posterity woodlands more and more depleted. The result is only a question of time. The natives of parts of South Africa tell of giant trees and forests, fertile lands, and abundant floods and showers, all existing or occurring in a region now little more than a dry and arid desert; such will be the traditions of our own descendants. As the soil becomes unfit for agriculture, migrations will follow, favored regions will receive an overplus of population which cannot obtain all its supplies from the soil, and dependence upon other nations for necessaries of life, the first step downward in a country's decadence, is taken. Exhaustion of resources must ultimately succeed, and with it the end of national existence.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, March 30, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	7 09 eve.	Saturn rises	5 27 mo.
Venus rises	3 58 mo.	Uranus in meridian	9 20 eve.
Mars sets	11 08 eve.	Uranus sets	4 12 mo.
Jupiter rises	3 01 mo.	Neptune sets	8 28 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	11 28 eve.	Sirius in meridian	6 07 eve.
Regulus in meridian	9 29 eve.	Procyon in meridian	7 00 eve.
Spica rises	7 23 mo.	Aldebaran sets	10 54 eve.
Arcturus in meridian	1 41 mo.	Algol (2d-4th mag. var.) sets	11 36 eve.
Altair rises	0 46 mo.	Capella sets	2 46 mo.
Vega rises	9 06 eve.	7 stars (cluster) sets	10 36 eve.
Deneb rises	10 08 eve.	Betelgeuse sets	11 41 eve.
Alpheratz sets	7 24 eve.	Rigel sets	10 06 eve.

REMARKS.

Venus is upon the boundary between *Aquarius* and *Capricornus*, being about 5° southwest of the λ. Mars is about 7° directly north of Aldebaran in the Hyades being a trifle north of the earth's path. Uranus is 1° 5′ north and 9m. west of Regulus.

IT is intended to form in Paris a commercial and industrial museum, where the public will find samples of raw materials from all parts of the world, and samples of articles produced therefrom.

© 1878 SCIENTIFIC AMERICAN, INC

Atlantic Wrecks for Thirty-seven Years.

We have before us a record showing the number of lives lost in crossing the Atlantic during the last thirty-seven years. In this period fifty-six fine steamers have been wrecked, and in twenty-nine instances more or less lives were lost. Nine vessels were never heard from after leaving port. These are the President in 1841, the City of Glasgow in 1854, the Pacific in 1856, the Tempest in 1857, the United Kingdom in 1868, the City of Boston in 1870, the Scanderia in 1872, the Ismailia in 1873, and the Colombo in 1877. The number of lives which were thus blotted out aggregates 1,397. Of the remaining vessels, four were burned, five sunk by collision, two by colliding with icebergs, two foundered at sea, and thirty-four were wrecked on various coasts. This is a suggestive showing, for it at once calls into contrast the relative peril incurred by dependence upon human judgment and human handiwork. Of the entire total of steamers lost, in but two cases can the disaster be attributable to a breakdown of the machinery; namely, the Anchor line steamer Hibernia, which foundered through her propeller shaft having been withdrawn from its place after the propeller had been lost; and the other the Ismailia, of the same line, which was once spoken under sail, her machinery being disabled, and was never heard of afterward. Neither has any boiler explosion occurred on an Atlantic steamer during the period mentioned. So far as the record before us is authority, the inference therefore is that the greatest loss of life is due not to lack of safe vessels, but to failure in judgment or the incompetence of those who handle them.

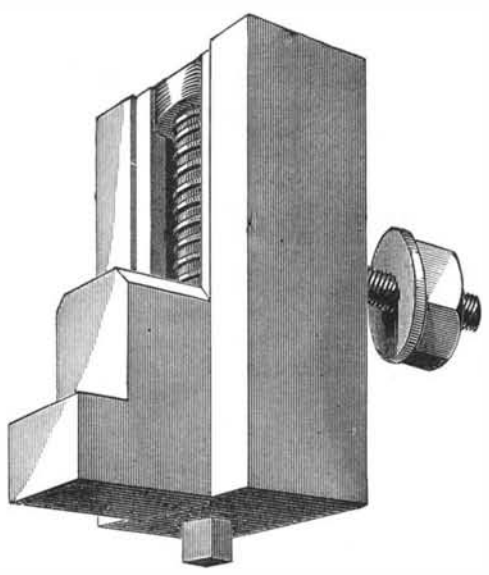
Thirty-four steamers, as above stated, have been wrecked, and an inspection of the localities where the wrecks occurred shows that several have happened in about the same vicinity. For example, the City of New York in 1861 and the Chicago in 1868 were both wrecked on Daunt's Rock, near Queenstown. No less than twelve have been destroyed on the coasts of Nova Scotia and Newfoundland. It may be asked if vessels cannot be built strong enough to withstand driving upon the rocks as in the cases of the Atlantic and the Schiller, at least for a sufficient time to enable the passengers and crew to obtain assistance or make their escape; but here the question of cost obtrudes itself, and the answer of those who have considered the subject is that vessels cannot be so constructed and yet profitably used. Taking this into account with the aggregate number of lives lost, in all 4,780, and it will be evident that the problem of reducing the dangers of the sea becomes, as we have frequently urged, one depending on the efficacy of life saving inventions. Devices which will keep large numbers of people afloat for considerable periods, devices that will keep individuals above water that can be rapidly adjusted to the person with no possibility of mistake, devices for taking lines from wrecked vessels to the shore, devices for indicating the relative positions of ships to each other, new signals for fog and night, and contrivances of that nature, all are subjects for the inventor's skill in devising better modifications and improvements.

A LARGE SUGAR MILL.

The sugar cane mill shown in the accompanying engraving is the largest which has yet been made in this country, and is of a character which leads the London *Engineer* to remark that there is reason to believe that in this class of machinery American makers will soon compete largely with English engineers. It was made by the Farrel Foundry and Machine Company, of Ansonia, Conn. It is driven by a Corliss beam engine (shown at the left of the illustration), with a cylinder 30 inches in diameter and 5 feet stroke. The cane mill rollers are 44 inches in diameter, and 90 inches long on the face. The castings for the entire mill weighed over 300 tons, the nature of the work demanding peculiarly substantial parts. The operation of the machinery may be readily understood without further detailed description.

INDEPENDENT JAW FOR LATHE CHUCKS.

We illustrate herewith an improved jaw for lathe chucks, which can be fixed in any desired position so as to hold pieces of any irregular form. It can be quickly removed from the chuck and attached to the face plates of engine and shafting lathes, drilling and boring machines, or to the platen of planers and milling machines. The manufacturers claim that the device never gets clogged with chips or dirt or the screws out of order, causing it to work with difficulty. It can quickly be removed from one lathe to another, thus saving the use of several chucks, and is further claimed to be



INDEPENDENT JAW FOR LATHE CHUCKS.

the only jaw adapted to chucks of large diameter. It is made of wrought iron or steel and case hardened. The screws are of steel. The large sizes have two or more bolts to fasten them to the chuck. For further information address the American Twist Drill Co., Woonsocket, R. I.

Telephone Notes.

Mr. W. H. Preece considers that the telephone may be employed both as a source of a new kind of current and as a detecter of currents which are incapable of influencing the galvanometer.

It shows that the form and duration of Faraday's magneto-electric currents are dependent on the rate and duration of motion of the lines of force producing them, and that the currents caused by the alteration of a magnetic field vary in strength with the rate of alteration of that field; and further, that the infinitely small and possibly only molecular movement of the iron plate is sufficient to occasion the requisite motion of the lines of force. Mr. Preece has also pointed out that the telephone explodes the notion that iron takes time to be magnetized and demagnetized.

The best way to adjust the magnet, that is, as near as possible to the plate without touching, is to sound the vowel sound *ah* or *o* clearly and loudly; a jar is heard when the parts are too near together.

Mr. Preece has found that, if the telephone wire be inclosed in a conducting sheath, which is in connection with the earth, all effects of electric induction are avoided; and further, if the sheath be of iron, magnetic induction also is avoided and the telephone works perfectly.

The leakage on pole lines is fatal to the use of the telephone in wet weather for distances beyond five miles.

Hon. Rollo Russell, says *Nature*, has made some experiments, which go to prove that there is no need to insulate the wires connecting a pair of telephones, at least when used for short distances. No. 18 uncovered copper wire was laid along grass and trees 418 yards, the two lines being kept well apart, and articulation was very well heard. The same wire was buried for three yards in wet clay, when telephones 20 yards apart gave good results, showing that bare wires may be taken under roads, etc., without diminution of the audible effect. Conversation was heard through lines submerged in water about 40 yards and lying on the grass for 28 yards.

M. Demoget, of Nantes, calls attention to the fact that if two telephones be placed in direct communication with the two wires of a Ruhmkorff coil, so as to close the circuits of each by means of these wires, if one or the other of the telephones be spoken into, the second transmits the sounds just as if both were in direct communication with one another. Another fact noted is that two telephones in double circuit may be disposed at the end of a line, and if both be simultaneously spoken into, two voices are heard in a single telephone at the other end of the line. M. Demoget therefore suggests the placing of two or three telephones of different pitch in a chamber forming a resonator, in order to obtain more intense and more distinct sounds.

Modern Marine Engine Economy.

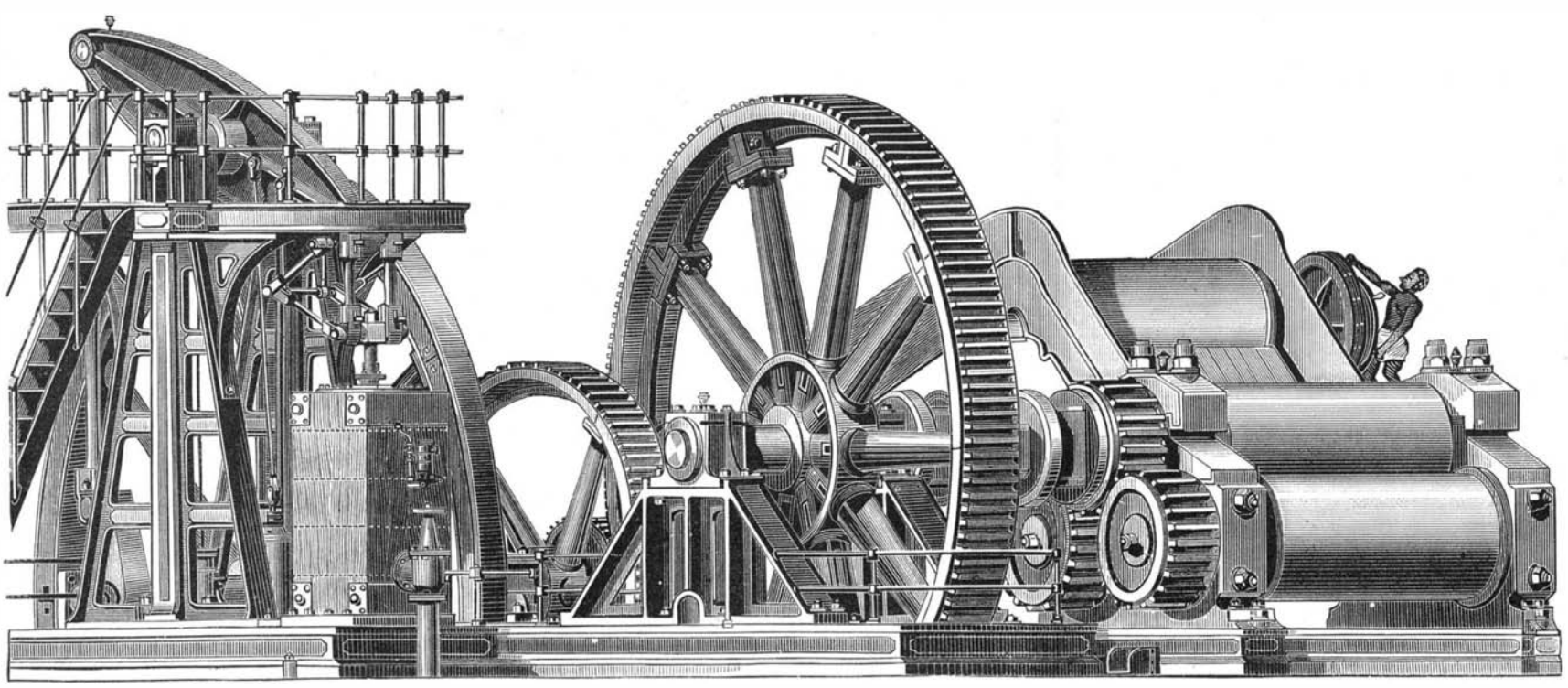
One of the most suggestive illustrations that can be adduced as showing the advances made within the last forty years in marine engine economy is derivable from an examination of data calculated by Mr. Arthur J. Maginnis from recorded averages of Atlantic steamships—and more especially of those of the Cunard paddlewheel steamer "Britannia" in 1840, and the White Star screw steamer "Britannic" in 1877. Of the first vessel the average duration of passage was 14 days and 8 hours, and the consumption of fuel 544 tons, the daily consumption thus being 38 tons.

Assuming the average cargo at 225 tons, this gives 48·35 cwt. of coal per ton of cargo; and the average speed in knots per hour being 8·3, the consumption per knot was 3·8 cwt. The indicated horse power was 740, and consumption per horse power, 4·7 cwt. The Britannia displaced but 2,050 tons, and this must be taken into account in comparing her with the Britannic, whose displacement is more than four times as great, or 8,500 tons. That vessel, in 1877, showed an average passage of 7 days 10 hours and 53 minutes, an average daily consumption of fuel of 100 tons, or total consumption of 745 tons. Her cargo is 3,350 tons; consumption of fuel per ton of cargo, 4·45 cwt.; average speed, 15·6 knots; consumption per knot, 5·3 cwt.; indicated horse power, 4,920; consumption per horse power, 1·9 cwt.

In other words, we are now enabled to transport 15 times as much freight across the ocean in one half the time at an expenditure of less than one and a half times as much coal as in 1840.

Ocean Phenomena.

Mr. J. J. Wild, in his new book on the ocean, based on the data obtained during the Challenger Expedition, states that in the beds of the Atlantic and Pacific there are immense valleys reaching a depth of 17,280 feet below the surface. In the Pacific, south of Asia and around Australia, the depth is 11,500 feet, and near Japan it attains 22,400 feet. The temperature of the sea depends upon the latitude, currents, and the season of the year. If no perturbing cause existed there would be isothermal lines of ocean temperature parallel to the equator. But warm currents travel from the tropics to the poles, and inversely cold currents move from poles to tropics and break up all uniformity. At the equator the average surface temperature is 80·6° Fah.



SUGAR CANE CRUSHING MACHINERY.

© 1878 SCIENTIFIC AMERICAN, INC

THE NEW OTTO GAS ENGINE.

The annexed illustrations, for which we are indebted to the Belgian *Bulletin du Musée de l'Industrie*, represent the new Otto horizontal gas engine. In general appearance this machine closely resembles the ordinary horizontal steam engine. A cylinder receives a piston, which on starting draws in air and gas mingled in certain proportions. A flame brought in contact with this mixture produces its rapid combustion. The high temperature thus engendered results in considerable pressure, and the gases act by expansion upon the piston, drive it ahead, and it in turn communicates its motion to connecting rod, crank, etc. There are four distinct phases of operation for every two turns of the flywheel, namely: 1. Aspiration of air and gas; 2. Compression of the mixed gases; 3. Combustion and impulse given to the piston; and 4. Escape of the products of combustion. So that it will be seen that the piston receives but one impulse for every two revolutions.

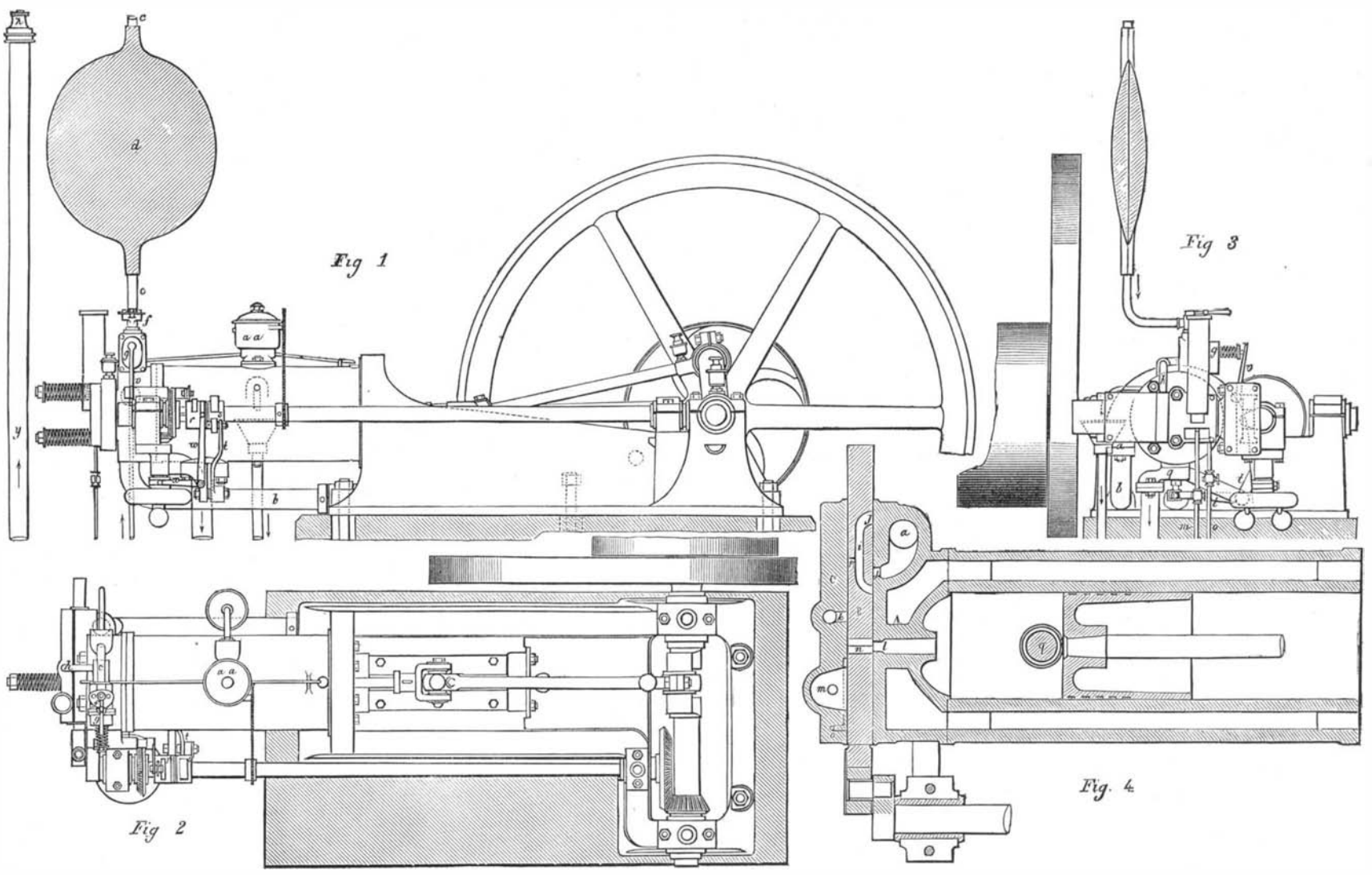
On the slide, A, Fig. 4, in rear of the cylinder moves the valve, B, which is retained in place by the cover, C, and by spiral springs which allow of some yielding at the moment of ignition. The slide or breech, A, has a tubulure, *a*, which leads air into the cylinder by the tube, *b*, which communicates with the bed block, in which last is the air reservoir. The gas is conducted by a tube, *c*, Fig. 2, in a rubber pocket, *d*, which serves as a pressure regulator, and enters the cover, C, by the stop valve, *f*, and valve, *g*, passing through the tube, *h*. The air and gas penetrate into the cavity, *i*, Fig. 4, in the valve, B, traversing the orifices, *j* and *k*, and thence enter the cylinder by the aperture, *l*. The cover, C, has two small gas tubes provided with cocks. One of these, *m*, terminates in a burner which is constantly lit during the operation of the machine, its object being to ignite at intervals a small quantity of gas carried into the cavity, *n*, of the slide valve by the tube, *o*.

The valve, B, is moved from the main shaft by bevel gearing and a lateral shaft terminating in a small crank, the velocity of rotation of which is one half that of the motor shaft, so that one stroke of the valve corresponds to two revolutions of the main shaft.

During the first two phases above noted (aspiration and compression), which correspond to the first turn of the motor shaft, the cavity, *n*, in the valve, B, is filled with gas, which is ignited at the passage of the flame fed by the tube, *m*. At the beginning of the third phase, which corresponds to the dead point of the motor crank, and which coincides with the beginning of the second turn of the shaft, the cavity, *n*, of the valve containing the ignited gas uncovers the orifice, *l*, in the breech, A, and thus places the mixture in the cylinder in communication with the flame, producing combustion. The impulse received by the piston is then the motor force.

In order to expel the products of combustion which remain in rear of the piston, the cylinder has a valve, *q*, operated by the lever, *t*. The play of the latter is governed by a small cam fixed on the sleeve, *s*, of the lateral shaft. This cam is regulated so as to push the lever and consequently to lift the valve at the moment the piston begins its back stroke in the second turn of the motor shaft. The cam leaves the lever when the piston is ready to begin a new aspiration—that is, at the commencement of the third turn of the flywheel. The lever then returns to its primitive position, aided by a spring, and the valve closes. The lateral shaft carries a second sleeve, *r*, Figs. 1 and 3, having a cam which governs a lever, *v*, and which in its turn moves the gas valve, *g*, in order to give passage to the gas which produces the explosive mixture. The sleeve, *s*, is connected with the regulator by a lever, *w*. When the motor exceeds its required speed, the regulator lifts, displaces the sleeve, and prevents admission of the gas until normal velocity is regained. The engine meanwhile runs of its own momentum, and the consumption of gas is thus modified according to the work to be done.

The cylinder has a double envelope with water circulation between, in order to prevent overheating of the parts exposed to the hot gases. The heated water is returned to its reservoir and is cooled by contact of the air. To prevent the noise made by the escape of suddenly expanding gases into the atmosphere, the exhaust is led by a pipe first into a reservoir, whence it passes into the atmosphere by the tube, *y*, and ajutage, *z*, Fig. 1. The consumption of gas by this engine varies in some degree according to quality of the former; it averages, however, about 35·3 cubic feet per hour.



Mica Ventilators.

To promote ventilation in rooms, a little wind-rose or wheel with vanes is often used, being inserted in an aperture in a window pane. The draught sets it in rotation. M. Raphael, of Breslau, makes such ventilators of mica, with a narrow metallic outer rim, which is connected with a small metal wheel round the axis by twelve vanes of mica. Among the advantages claimed for these mica wheels over those of metal are the following: Mica is transparent like glass, and so does not darken the room. The variations of temperature and moisture of the air have no effect on it, whereas metal ventilators, through changes of temperature, are apt to be displaced on their axes and have their rotation hindered. The movement is much easier, mica being so very light. Mica is, further, a very bad conductor of heat, so that one side of a plate of it may be too hot to touch while the other can be held quite well.

Microscopical Notes.

Dr. Joseph G. Richardson has directed attention to a method of his own for enumerating the red and white corpuscles of blood, which, he claims, obviates the difficulties which have previously existed to the accomplishment of this important work.

After describing the older methods of Henri Bonne and others, Dr. Richardson suggests the following plan: Take a clean sewing needle (No. 6) and two ordinary glass slides, and having punctured the middle finger of your patient, squeeze out a drop of blood the size of a pin's head, touch the apex of this drop to the surface of your labeled slide near its end, and then immediately spread it out by means of the edge of your other glass slide applied to the portion of the blood drop which adheres to the first slide, and while holding slide No. 2 at an angle of 45°, drawing it rapidly along the flat surface of No. 1, in such a way as to leave a faint reddish film equally distributed over the latter. In half a minute or less your preparation dries, and if protected from dust and moisture, may be examined any time between this and 1978. After writing the name of the patient and date upon the label, inspect as soon as convenient under a power of 200 diameters.

If a comparison is made with a specimen from a healthy person, the presence or absence of any marked change in the ratio of the red and white corpuscles may be observed.

In order, however, to establish the *amount* of alteration, and for the purpose of facilitating the enumeration of the colorless globules, and ascertaining their proportion to the red disks, the following scheme is suggested:

Provide, in the first place, a stage micrometer, ruled in ½ mm. upon glass about half the thickness of an ordinary slide. Lay your blood specimen upon the stage of the microscope, find an area of ½ mm. in width by 5 mm. in length, where the corpuscles are spread so thickly as to almost touch, and yet are in no case superimposed upon each other. Such an area as this can generally be met with quite readily. Lay upon it your ½ mm. micrometer face downward, so that its lines can be seen (somewhat indistinctly perhaps), at the same time the blood globules are in focus.

Secondly, procure an eye piece micrometer with very coarse divisions, the lines of which are $\frac{1}{20}$ of an inch ($\frac{8}{20}$ of a mm.) apart, and place it in your A eye piece, so that its lines divide the field of view into from 8 to 12 transverse bands, each about the width of 5 red blood corpuscles, as seen with a ¼ or ⅛ objective.

These pieces of apparatus are aids to count the red disks, which should be done and recorded as a unit of enumeration for the white corpuscles.

This counting is best done by adjusting the camera lucida, drawing on white paper the outlines of the field of view, with both the transverse lines of the eye piece micrometer and the vertical lines of the stage micrometer, and then counting the individual globules in a band at a time, dotting each corpuscle as counted, so that none may be missed or twice noticed.

For perfect accuracy, the red and the white corpuscles must be counted in each field, but it is not worth while to undertake this. For practical purposes consider the number of red disks in each field of a given lens and eye piece, where these disks nearly touch, but are not piled upon each other, as identical, and the sum of the white corpuscles observed in ten successive fields answering this description, divided into ten times the number of red disks counted in one such field, shows the ratio of the white to the red corpuscles.

© 1878 SCIENTIFIC AMERICAN, INC

For example, with the ¼ inch objective and A eye piece of Power and Leland, I find the field of such a single layer of blood as that above described shows 3,000 red disks, and that in ten fields displays about 100 white globules. Dividing now 100 (the number of the leucocytes) into 30,000 (the number of red disks in ten fields, each ½ a mm. wide), I obtain the fraction $\frac{100}{30000}$, or reduced to its lowest terms $\frac{1}{300}$, as the proportion which the white bear to the red corpuscles.

In doubtful instances the leucocytes may be distinguished from the red disks by turning the fine adjustment so as to raise the lens a little, when the white corpuscles usually display a peculiar fatty luster. Care must be taken to avoid mistaking unusually large aggregations of the fatty (?) molecules of the blood for leucocytes.

Having thus obtained the true ratio of the white globules to the red, it becomes an easy matter to calculate the actual number of the leucocytes in each cubic millimeter of blood, after we have determined by the aid of Hématimètre, of Hayen and Nachet, or of Malassey, the number of the red corpuscles in that quantity of the circulating fluid.

Dr. Richardson gives 5,000,000 as the average number of red disks to the cubic millimeter in the blood of a healthy subject.

PRESERVATIVE FLUIDS FOR MICROSCOPIC SPECIMENS.—The following formulæ are by F. Meyer:

(*a.*) For larvæ, hydræ, and nematodæ: Glycerin, chemically pure at 124, 1 part; distilled water, 2 parts. To ten parts of this mixture add one part of the following solution: Pyroligneous acid at 1040, 100 parts; salicylic acid, 1 part.

(*b.*) For infusoria: Glycerin, 1 part; distilled water, 4 parts. To ten parts of this add one part of the above solution of salicylic acid.

(*c.*) For algæ: Glycerin, 1 part; solution salicylic acid, 1 part; distilled water, 20 parts.

TROY SCIENTIFIC ASSOCIATION.—The annual soirée of the Microscopical Section was held on the 4th inst., at the house of Dr. R. H. Ward. The plan adopted was most excellent. Fifty-eight objects were shown by eleven gentlemen, each of whom exhibited specialties in some particular field of microscopy. Twenty-nine microscopes were employed. Those arranging similar soirées would do well to obtain a copy of the printed programme from Dr. R. H. Ward, of Troy, by which they will notice the general arrangements.

Communications.

Locomotive Strokes.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of March 9, 1878, it is suggested by Mr. F. G. Woodward that our locomotives might be made more efficient and serviceable for freight work by giving them just one half of their present piston area and doubling the length of their stroke. I cannot agree with Mr. Woodward that there is any gain whatever. From my standpoint I will say that the proposed change has no practical or theoretical advantage.

For example, let us take two locomotives of the same weight, boiler capacity, and tractile force, one, as at present constructed, with a 12 inch crank and cylinders of 16 inches diameter by 24 inches stroke; the other (as proposed) with a 24 inch crank and cylinders of 8 inches diameter by 48 inches stroke.

As the cylinder is where the power is applied, we must commence there. The area of our 16x24 inch cylinder, we find, is 201·0624 inches, and it has a cubic capacity of 4,825·4976 inches contents of one cylinder, while we have another on the other side of the same dimensions. To ascertain the full area and cubic contents, we simply multiply by 2, which gives us 402·1248 inches area, and 9,650·9952 cubic inches. Let us pursue the same course with Mr. Woodward's proposed cylinder, one half of the above diameter and twice the stroke. We have a cylinder of 8 inches in diameter and 48 inches stroke, of an area of 50·2656 inches and 2,412·7488 cubic inches. Both cylinders represent an area of 100·5312 inches and 4,825·4976 cubic inches. The difference found in total areas in favor of the standard engine is as 4 to 1, while the cubic capacity is just 4 times that of Mr. Woodward's plan.

Suppose we use a little steam in our 16x24 inch cylinder, at a pressure of 125 lbs. per square inch, and cut off at 8 inches. We have 1,608·4992 cubic inches of steam to expand into 16 inches before exhausted in one cylinder, and twice that in both cylinders, namely, 3,216·9984 cubic inches. The same with Mr. Woodward's plan would represent 402·1248 cubic inches in one cylinder and 804·2496 cubic inches in both cylinders, with 40 inches to expand before exhaustion.

We find the ratio of expansion in the former to be 1 to 2, the latter 1 to 5, provided there is nothing lost by condensing in either case; in other words, our cubic inch of steam would be exhausted at one half of its pressure in the former and one fifth in the latter case, assuming that there is none consumed to overcome the friction in either cylinder.

The suggestion presents itself to me in the following light: We have a 16x24 inch cylinder with 1,608·4992 cubic inches of steam exerting its force on 201·0624 inches area of surface (cut off at 8 inches), and forcing that surface through a space of 16 inches and exhausting itself in the air at one half of its pressure; on the other hand, we have 402·1248 cubic inches of steam exerting its force on 50·2656 inches area of surface (cut off at 8 inches), and forcing that surface through a space of 40 inches, exhausting into the air at one fifth its pressure. This result presents itself: The more inches of area there are, and the less space to travel through, the greater the power; while the less area and greater distance to travel, the less power we have. The difference in favor of the 16x24 cylinder will be readily seen by the following:

16"x24" cylinder	*versus*	8"x48" cylinder.
201·0624 area	"	50·2656 area.
1,608·4992 cubic in. (cut off at 8"),		402·1248 cubic in.

Or four times the power in favor of 16"x24", with the 12 inch crank. Assuming that Mr. Woodward would gain twice the power on the crank, we have yet twice the power in favor of the present locomotive.

JOHN A. HOLMES.

East Buffalo, N. Y., March 8, 1878.

The Prevention of Explosions in Mines.—An Invention Needed.

To the Editor of the Scientific American:

Permit me through the columns of your journal to call the attention of inventors in general to a matter of vital importance to thousands of our laborers, and which will amply reward the successful inventor who turns his attention thereto. I refer to the discovery of some method or plan by which the explosions of inflammable gases in coal mines may be prevented. Accidents, nearly always fatal, are of almost daily occurrence in the anthracite coal regions of Pennsylvania, and aside from the loss of life and mutilation of the miners, the damage done to the property of the mine owners is almost beyond computation. The inventor who succeeds in effectually preventing these disastrous explosions will not only prove a public benefactor, but the fruits of his invention will enrich him to an extent greater than the profits of any average business could reward him for a lifetime of labor. To those who will turn their attention toward this matter I would say that the most perfect system of ventilation alone will not effect the object sought, and most mines are so constructed that it is next to impossible to force more pure air into them than is barely necessary for the support of the miners' existence. The proper ventilation of mines is provided for by law in this State, and nearly all mine owners comply with the law to the extent of their ability; but there are natural obstructions to thorough ventilation. In such cases the miners are compelled to work in the gas, using the safety lamp, which in many cases has unfortunately proved to be a safety lamp in name only. Old practical miners, men who have spent their whole lifetime in the mines, assert that the most destructive explosions always occur in dry mines, while wet workings are to a great extent free from such dangers. They explain this by saying that in all dry workings the atmosphere is charged with finely powdered coal dust, which alone is dangerous, but when mixed with the explosive gases forms a matter tenfold more dangerous in case the gas is fired. I quote below Section 7 of the mine ventilation law for the guidance of those who may wish to pursue the investigation of this subject:

"SECTION 7. The owners or agents of every coal mine or colliery shall provide and establish for every such coal mine or colliery an adequate amount of ventilation, and not less than fifty-five cubic feet per second of pure air, or thirty-three hundred cubic feet per minute, for every fifty men at work in such mine, and as much more as circumstances may require, which shall be circulated through to the face of each and every working place throughout the entire mine, to dilute and render harmless and expel therefrom the noxious, poisonous gases to such an extent that the entire mine shall be in a fit state for men to work therein, and be free from danger to the health and lives of the men by reason of said noxious and poisonous gases, and all workings shall be kept clear of standing gas. The ventilation may be produced by using blowing engines, air pumps, forcing or suction fans, of sufficient capacity and power, or other suitable appliances, so as to produce and insure constantly an abundant supply of fresh air throughout the entire mine, but in no case shall a furnace be used in the mine, where the coal breaker and chute buildings are built directly over and covering the top of the shaft, for the purpose of producing a hot up-cast of air; and there shall be an in-take air way, of not less than twenty square feet area, and the return air way shall not be less than twenty-five square feet."

Now it has always been considered impossible to free a mine entirely of explosive gas by trying to expel the gas with the force of a current of pure air, and yet we have never heard of any plan of preventing danger and explosions excepting the ventilation method. In some mines (a very few) it works well enough to answer all practical purposes, but in a large majority of cases, and in all large mines, it fails to be effectual simply because as the mine is worked gas is being constantly freed, and miners are liable at any time to strike a "feeder" or current of gas which the air is powerless to expel. It may be that some one of our inventors will devise a plan of ventilation that will prove more perfect than those now in use, but the chances are that no such system will ever prove a perfect safeguard against explosions. What is needed and what we think is the key to the whole subject is the discovery and application of some neutralizer which will destroy the explosive nature of the gases. To dilute the gases with air and allow them to become impregnated with the atoms of coal floating in the mine atmosphere renders the gases more dangerous than when in a pure state, and the knowledge that the gases are diluted renders ignorant miners much more careless at a time when they are in imminent danger. A substance or method that will abate the destructive power of mine gases will enrich the discoverer beyond the most sanguine expectations, will make him a public benefactor, and will enroll his name on the scroll of Honor and Fame in letters that will endure for centuries to come.

HORACE B. MCCOOL.

Pottsville, Pa., March 7, 1878.

Power Required to Run a Velocipede.

To the Editor of the Scientific American:

In your issue of February 9, G. O. A. asks: "Is there a practical velocipede, that is, one which would enable a man of ordinary muscular development to travel a distance of 20 miles on a good country road in less time and with less fatigue than he could do it on foot?"

In your issue of 16th inst., a correspondent, Jno. B., replies in the negative, and though it would appear from his communication that his experience ought to be considerable, yet I am (from experience also) compelled to differ with him, and before giving my experience, I may state that I am not the possessor of any extraordinary amount of muscular development; on the contrary, I am rather under the average in that respect, my weight being about 140 lbs.; yet I have ridden a velocipede on "a good country road" in one day, a distance of 52 miles, the actual running time, or the time deducting stoppages, being 7½ hours, a feat which I could not have performed on foot under any circumstances, yet I accomplished this without feeling any unusual fatigue. This is the greatest distance that I ever had occasion to make in one day, but have frequently ridden a distance of 30 miles for amusement.

Your correspondent, Jno. B., says that it "is impossible, under any circumstances, to run a velocipede through a given distance with the same expenditure of power as that required to walk the given distance;" but let us look at it for a moment, and it will be evident that in walking the whole weight of the body must be supported on each foot alternately, which, in my case, would mean a force of 140 lbs. expended every step, besides that required to propel the body forward a distance of about 33 inches. Now let it be remembered that in riding the velocipede, the whole weight of the body is borne by the vehicle, and allows the rider to exert all the power employed for the purpose of propelling himself forward; and it must also be remembered that in riding the velocipede with, say, a 42 inch wheel, the rider at each step can propel himself forward a distance of 126 inches, or $3\frac{2}{33}$ times the distance that he would move in walking at an ordinary gait.

I have never actually tried the force required to be exerted on the pedals of a velocipede to propel myself forward, but I am satisfied that it does not require more than that which is required to sustain the weight of the body and propel it forward in walking.

I might draw your correspondent's attention to the fact that one man can move a loaded car on a level railway track, yet no one would expect him to carry it.

Your correspondent's idea of a man going on a journey and drawing a velocipede after him is simply ridiculous, and reminds one of a person who, in attempting to draw a saw log lying on the ground, would refuse to attempt to draw it on a truck on account of the additional weight.

I am perfectly satisfied that a man of "ordinary muscular development" can travel a distance of 20 miles on a properly constructed velocipede with a less expenditure of power than he could walk the same distance.

Hoping some of your correspondents will give a more scientific exposition of the reasons why than I am able to give, I remain yours, VELOCIPEDE.

Chatham, March 11, 1878.

[For the Scientific American.]

PLANT MIND.

I.

THE SOUL OF PLANTS AND MODERN SCIENCE.

Vegetable physiology has made but slow progress. Although its beginning may be traced to the period when Malpighi aided it with the microscope, its real origin does not date earlier than the last century, when, by his beautiful experiments on the nutrition and transpiration of plants, Hales explained some curious phenomena in the vegetable world.

From that time naturalists began to study attentively the phenomena of vegetation.

The observations of Linnæus and Holff, the numerous experiments of Bonnet and Senebier, the works of Duhamel, Ludwig, and Mustel, the investigations of H. de Saussure and Hedwig—all these efforts tended toward the same end, namely, reuniting scattered materials and forming a regular whole. Some of these in studying the life of plants examined more particularly the form, structure, and development of their organs; while others attempted to explain their play and functions. The result of these labors was the birth of two new sciences—vegetable physiology and organography.

Modern physiologists have observed some extraordinary phenomena in plants, with which they have been differently impressed. They all, it is true, recognize a sensible analogy between these facts and certain animal instincts; but some see in these only isolated phenomena of secondary importance, and propose to explain them by altogether mechanical or physical theories; while others, on the contrary, attracted by the singularity of these facts, have studied them with close attention, and as the result of their observations have come to the conclusion that a plant is an animated being. This is substantially admitted by Vrolik, Hedwig, Bonnet,

© 1878 SCIENTIFIC AMERICAN, INC

and Ludwig in their writings upon the phenomena which seem to reveal a vegetable instinct. They all incline to the belief that plants experience every order of sensations.

F. Edward Smith, the English botanist, thinks that plants can feel, and are capable through that faculty of a consciousness of well being and felicity.

Percival believes that plants perform voluntary actions when they turn their branches to the light.

Among the philosophers of the eighteenth century who saw animated beings in plants must also be ranked Dr. Erasmus Darwin, the grandfather of the celebrated naturalist, whose recent works have thrown some light upon the vexed question of the origin of species. In that book, too little known, but the delight of Goethe ("The Botanic Garden"), Dr. Darwin plainly asserts that in his eyes the plant is an animated being—a creature capable of numerous sensations, as of existence, of pain, and gladness.

Dr. Martius, one of the most eminent men of modern science, accords to plants not only the faculty of feeling, but also an immortal soul. To the voice of that celebrated botanist there has been lately added that of another, namely, Theodore Techner, an independent thinker, and not the least inspired among his German cotemporaries. He was one of the first to enter into the questions which bear upon the development of the soul in plants. The new ideas and original views with which his book abounds entitle it to be considered as the first advance towards a true vegetable psychology. A soul in plants was recognized by the ancients. Empedocles, Anaxagoras, Democritus, Pythagoras, and Plato believed plants to be animated, and consequently ranked them with animals.

Entire peoples—the Hindoos, for example—have also regarded plants as animated beings. Among the laws of Manu, laws which in India are believed to have emanated from God, and to be more ancient than those of Moses, are to be found doctrines and commandments as follows:

"It is good and equitable that each father of a family, without prejudice to his children, should reserve one part of his wealth for other animated beings, to wit: plants and animals."

"Plants and animals have internally the sentiment of existence, and also of pain and happiness."

According to Loubère and some other travelers, the priests of Siam and Laos apply the law forbidding to kill not only to men and animals, but also to living plants. They exhibit as much repugnance to the destruction of a tree, or simply the cutting of a branch, as to the mutilation of a man; and they refuse to eat of green fruits lest their development should be arrested. These views are entirely opposed to those which belong to the people of the Occident. From earliest childhood, in our schools and elementary books, children are taught that men and animals have the faculty of motion and are living beings, and that plants attached to the soil live, it is true, but are not animated.

But, as M. Techner has observed, it would be quite otherwise if the preceptor said to his pupil, "Animated beings are divided into classes. One is composed of beings which possess the power of transporting themselves from place to place; these are men and animals. In the other class we find beings fixed in the soil where they are born; these are plants. The latter resemble us less than animals, yet live and grow as we do." For these and many other reasons we believe them equally animated. If our children are thus taught they will be less indisposed when older to deprive the plant of its soul than we are to recognize its existence at the present day.

Such numerous and striking analogies in the vital functions of beings in the two kingdoms, animal and vegetable, are revealed by physiology every day, that no one can refuse to reflect upon the facts or reject without a candid examination the proposition we are about to consider in a succeeding paper, that the plant is an animated and sentient being.

R. C. K.

WILD BEAST EXTERMINATORS WANTED.

It is somewhat strange that with the full knowledge that is possessed of the frightful numbers of human beings yearly slaughtered in India by wild beasts, some efficient means are not taken for the extermination of the latter. In 1875 20,805, and in 1876 19,273 people perished from this cause. This is considerably beyond the total mortality produced by wars before the invention of breechloaders and machine guns. For example, in 1855 statistics were published in England showing that in 22 years of war 19,796 people were killed. In nine great battles, including Waterloo, 4,740 fell. Even at the present time such a number of deaths occurring in a two years' war would be deemed large, and if they occurred through a pestilence in a great city the situation would be considered very grave. Yet to prevent such mortality in both instances every refinement of medical ingenuity and skill would be exerted; in the present case nothing is done beyond offering small rewards for the killing of the wild animals.

The loss does not end with that of human life. During the above two years the aggregate of cattle killed by tigers, snakes, and wild beasts generally aggregated 101,635. One tigress is known to have slaughtered 127 people, and stopped the traffic for many weeks on a public road. Another killed upwards of 50 people and caused the abandonment of 13 villages. Against the death rate of victims we can place the amounts paid for rewards for killing the animals, namely, for 1875, $52,326, and in 1876, $54,314, which is absurdly small in view of the magnitude of the evil to be prevented.

We look in vain through Dr. Fayrer's exhaustive paper on this subject, recently read before the Society of Arts, for a suggestion of a practical plan for checking these inroads. But one project is proposed, that of Captain Rogers, and that is the clumsy expedient of setting spring guns, which can with doubtful economy be made, we are informed, of old muskets. In connection with this system, which seems like the patent double-ender gun, dangerous alike to friend and foe, it is proposed to organize hunting parties of natives. These expeditions might also be considered as of doubtful value if we are to credit the assertion elsewhere made that the inhabitants have a "deep-rooted prejudice against killing a snake." Unfortunately the snakes have no deep-rooted prejudice against killing the inhabitants, as the latter succumb to poisonous bites at the rate of some 1,200 a year.

We have no means of knowing the exact value in which a Hindoo's life is held by the British Government, unless we divide the number killed by the amount paid to stop the source of death, and the result is two dollars and sixty-six cents per life; but from a humanitarian point of view it seems that the need of some potent means of eradicating this scourge is pressing. This consideration might be especially commended to the philanthropic gentry who so mercilessly condemned Stanley for his destruction in battle of a few dozen African savages. But if British ingenuity, which, by the way, still stands nonplussed over the grave problem of intercommunication between railroad carriages and locomotive, cannot suggest a feasible project, we venture to believe that the offer of an adequate reward will speedily bring forth plans from this side of the Atlantic. There are plenty of adventurous geniuses in the West who probably would willingly organize a corps of tiger exterminators to employ machine guns, hot water projectors, Greek fire, poisonous chemicals, or potent explosives, as their ingenuity might suggest, provided somebody made it an object to them to do so. Why cannot we have a "Scientific Expedition," under the auspices of the projectors of that much advertised one now begging Congress for a boost, to undertake this work? If participants cannot otherwise be obtained, there is the question of how to dispose of tramps still open.

THE PROGRESS OF ASTRONOMICAL PHOTOGRAPHY.

Astronomical photography comprises, first, the representation of the surface of celestial bodies sufficiently near to us to give a magnified image when observed with the telescope. Thus the sun with its spots and faculæ, the moon with all the details of her surface, and such large planets as Jupiter, Mars, and Saturn, have all been photographed. Secondly, it is possible to obtain by this means exact images of star groups, and thus to determine at once the relative situation of certain stars for a given epoch. By means of photography it is possible to observe as it were automatically passages of planets before the sun, eclipses, occultations of planets by the moon, and passages of stars at the meridian for the determination of absolute time. By its aid also we are enabled to reproduce the solar spectrum with all its lines, and to extend the limits thereof beyond the visible rays. Photographic pictures in the stereoscope also show very clearly the sphericity of the bodies represented. Lunar craters, the rings of Saturn, the spots and faculæ of the sun, there appear in high relief, and the observer is enabled to see that the faculæ are elevations and the spots depressions.

The finest astronomical photographs have been produced by Warren de la Rue in England, the late Father Secchi in Rome, Mr. Lewis Rutherford in this city, Ellery at Melbourne, Negt at Ghent, Gould at Cordova, and Janssen at Paris. Mr. Rutherford has obtained superb views of the moon with an exposure varying from one fourth second for full moon to two seconds for the first and last quarters. With these photographs M. Elie de Beaumont has shown how much may be deduced geologically with reference to the lunar surface, which is not affected by the destructive action of water or of any atmosphere. The comparison of photographs taken at long intervals apart also allows of the recognition of any changes which may have occurred in the lunar surface. It is now reasonably certain that active forces are at work in the moon's interior, and the disappearance some twelve years ago of a cavity which is shown on the maps of Maedler made in 1829 has educed the theory that it was filled up by an eruption of white material. This can only be verified by comparisons of photographs taken over many years.

Astronomical photography has recently, however, assumed a higher place than as a mere mode of reproduction of the images seen through the telescope. It has, in fact, become an important means of discovery, and the researches of Janssen have shown that photographic pictures reveal phenomena otherwise totally invisible. It was through such prints that he discovered the photospheric network around the sun. The great difficulty encountered in studying the solar photosphere has been to determine the exact form of the granulations or "willow leaves" which appear to form currents of semi-liquid matter. Small photographs showed little or nothing of these, and the reason is found in the phenomenon of irradiation, which causes the image formed by a very intense light to extend beyond its real boundaries and so to assume a false form. This was especially noticeable in all photographs of total eclipses; the images of protuberances trenched on the lunar disk often to the extent of 10 or 20 seconds. The same effect is produced on the eye. Now the average diameter of the granulations of the photosphere is but a second of arc, and it is therefore easy to perceive how a very small degree of irradiation suffices to confuse all the details of their form. Janssen has overcome this difficulty by enlarging the image and shortening the time of exposure. In a minute fraction of a second he obtains an image 10·8 inches in diameter. On this can be seen, first, a fine general granulation covering the solar surface. The grains, more or less rounded, have diameters varying from some tenths of a second to 3 or 4 seconds. The illuminating power of these granular elements is very unequal, doubtless because they are situated at very different depths, and those which attain maximum luminosity occupy but a very small portion of the solar surface. The most curious result, however, derived from an inspection of the photograph is that the photosphere appears divided into a multitude of compartments, having rounded or polygonal contours, the dimensions of which attain sometimes a minute or over (the diameter of the entire solar disk is about 32 minutes). In the intervals between these figures the grains are clear and well defined; in the interior they are half effaced, broken, and often absent. It may be supposed that in these spaces a violent commotion has mixed together or confounded the granular elements, and thus a new confirmation is afforded of the fact that the activity of the photosphere is always very great even when no spots are visible.

We have already fully described the apparatus used by the various expeditions for photographing the transit of Venus of 1874. It may well be asked if the immense labor spent upon the observation of that phenomenon has served to fix a value of the solar parallax more exact than that already obtained by other methods. All that is known at present is that the parallax deduced by the British Astronomer Royal from the direct observations of English astronomers (8·76″) is a little less than that determined by Professor Newcomb by taking the average of the best known results (8·85″). Examination of the photographs has further resulted in proof of the existence of an atmosphere around Venus.

Mr. Rutherford, of this city, has the honor of being the first to photograph the star groups, and he uses for that purpose a refracting telescope, 13 inch objective, mounted equatorially, and moved by clockwork. The duration of exposure depends upon atmospheric conditions, but about 4 minutes suffice for stars of the 10th magnitude. Mr. Rutherford has obtained very exact charts of the Pleiades, of the constellations Præsepe and Perseus, and of the stars near 61 Cygni. Gould, at the observatory of Cordova, has also achieved remarkable success in this line. Last November he possessed proofs suitable for the micrometric measurement of 84 celestial bodies, of which three fourths were star clusters. The plate representing the cluster of Eta of the Ship showed 180 stars, many of which are of the 9th magnitude. Mr. Gould has also obtained fine photographs of the moon, Jupiter, Mars, and Saturn.

THE NEW EGYPTIAN COTTON.

The Bahmian cotton, a new kind of plant not long since discovered in Menoufieh, Egypt, is puzzling botanists to determine whether it is a hybrid or some foreign kind accidentally brought into the country. It appears to be a cross between the Bahmian (*Hibiscus esculentus*) and the ordinary plant (*Gossypium barbadense*), the former having fertilized the latter at the time of blooming. The new plant presents marked characteristics. It has several straight stalks, of which the largest grow to a height of about three yards. In place of branches there are two or three pods, springing from the junction of the leaves and the stem which they surround. While the ordinary kinds of cotton resemble a shrub or bush, with one or more stems carrying a number of branches, sometimes much extended, bearing the pods (though often with intervals of two, three, or four leaves, without any at their junction), the leaves of the Bahmian cotton are large, strongly indented, and are of a much darker green than those of the other plants. The flower is yellow with interior purple spots, very like the ordinary cottons, though generally rather larger and carried on long stalks.

The report of the Egyptian Government on the plant points out that if it be a hybrid, the fact is of great importance scientifically, for such instances are rare in horticultural records between species so different; and those which have been produced to this time are generally sterile, while the new plant is more fruitful than the ordinary description. Last year all the great Egyptian growers tried the seed, and the crop is reported to be from 6,720 to 7,680 lbs. per acre. It is claimed that this will increase nearly 30 per cent with carefully selected seed and plants not overcrowded.

New Agricultural Inventions.

A Household Press for Fruits, etc., has been invented by Miss E. A. Stears, of Brooklyn, N. Y. This apparatus may be described as a box having formed on it a support for the nut of a compressing screw, and containing a drawer for receiving the juice expelled by the press, and having fitted to it a removable perforated cylinder for containing the fruit or other article to be pressed.

In an improved Plow and Seeder, or machine for scattering seeds and plowing them in, invented by Mr. P. H. Elliott, of Greenville, Texas, the essential addition is a rotating flanged drum composed of two perforated cylinders, one of which is adjustable about its axis, for the purpose of filling it with seed and also regulating the size of the discharge openings. This revolving seed distributer is placed in front of turn plows, applied to the draught frame.

An improved Grain Bagging Machine has been invented by Mr. F. H. Relph, of New York city. The chief element of the apparatus is a horizontal rotating frame carrying the

© 1878 SCIENTIFIC AMERICAN, INC

bags to be filled, and also funnels for guiding the grain into the bags as the rotating frame brings them successively beneath the discharge spout of a hopper. When filled, the weight of their contents causes the release of the bags from their suspending hooks, and at the same time closes the mouth of each bag by tension on a cord attached to it. The carrying frame is intermittingly rotated by means of a hinged trap and ratchet mechanism. Each bag, as it drops, falls upon and tilts the trap, which then rotates the frame sufficiently to bring the next empty bag in position for filling.

Mr. C. M. Mallory, of Wauseon, Ohio, has patented an improved Hay Elevator, by which the hay may be carried to and dropped in any corner of the mow, thus economizing space in a barn. This invention consists in a novel arrangement of hoisting, balancing, and guiding tackle of ropes, pulleys, etc., in connection with a windlass or horse power, arranged suitably for the purpose.

An improved Fruit Drier has been recently patented by Mr. Peter Riley, of Fort Scott, Kan. It has several tiers of sliding trays arranged laterally above a longitudinal fireplace at the bottom of the drier. The tiers are separated by vertical draught channels, and the front and rear parts of the trays are heated by lateral T-shaped pipes. A convex guard plate on the central part of the fire chamber protects the center of the trays from too great heat. The smoke pipe extends upward at the rear of a shorter tier of trays, and centrally through the space at the top part of the drier, to reheat the air at the top and keep up a draught through the trays.

IMPROVED SAW MILL DOG.

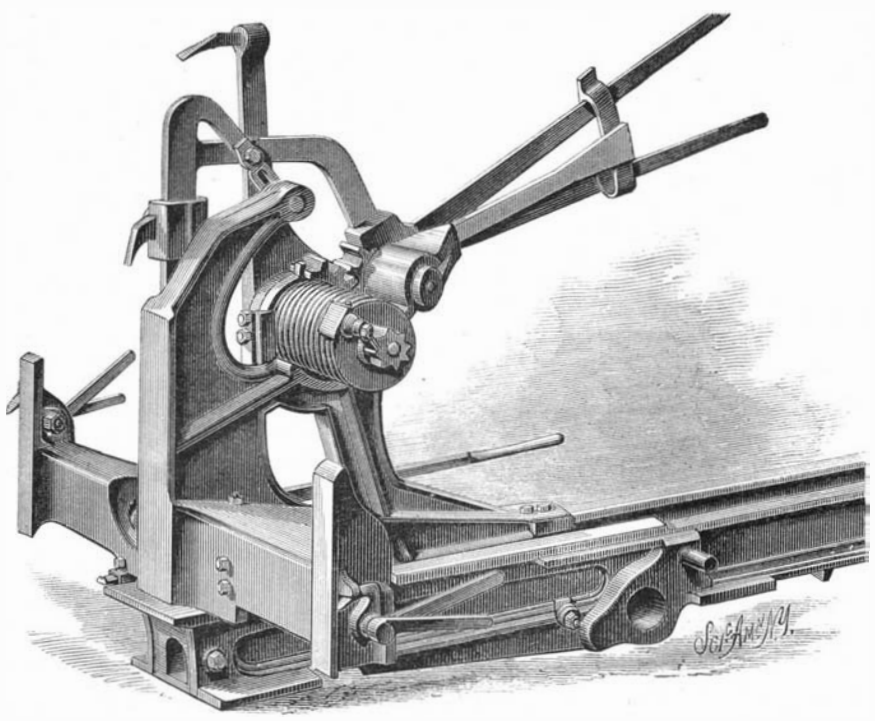
In the annexed engraving we illustrate a new dog for holding logs in the saw mill, which, we are informed, is built of the best material, is strong and durable, has very few joints, and retains the log with great firmness.

The arms are of such certain length, and their pivoted point of such height and distance from the face of the standard, that logs of large, small, or medium size are held with equal facility. The bits are of cast steel, set so as to enter the log easily, and are easily taken out and sharpened or replaced by duplicates. The shafts on which the arms are hung carry springs of such length, strength, and flexibility as make them convenient and effective in forcing the dogs into the log and holding them with a relentless grip until withdrawn by the lever by which they are operated. The length of the dog arms is made adjustable by spring pins, so as to allow a log of any size to be sawed into the thinnest flitches without danger to the saw.

The board dog, also of cast steel, is carried in a socket made to slide on an upright bar. The dog is raised or let down into the edge of a cant by a link and arm from a lever pivoted back of that by which the log dog is handled. Cogged segments connect this lever with one end of the spring case, so that the spring is utilized to operate either the log or the board dog as the lever of either is released from the latch which holds them when withdrawn from the timber. Pawls from the cases catch notches in the log dog shaft, so that more or less strain may be given to the springs at pleasure. The upright bars extend above the standards, so that the board dog may rise high enough to catch the highest cants. Its lower end is pivoted to the knee, so that the upper end will recede and allow large logs to come back over and rest on the standards. Strong leaf springs throw the bars forward when the log is turned away from them. Link joints connect the upper ends with the standards and hold them perpendicular or parallel with the face of the standards. The levers come back within convenient reach of the setter, who does not have to stoop to handle them.

A single dog only in each block is required to hold either the log or the cant, and its hold is sure. Any vibration or straining of the timber to get away only causes it to work in deeper, and to maintain its hold. The single dog, with straight tooth or bit, is easily kept in order and easily operated. Improved yielding spring dogs catch the under side of the cant and hold its lower edge. Thus both edges of the cant are held between jaws drawn together by powerful springs, and the face of the timber is uninjured by the perforations of any dog teeth.

The device has been in use in one of the largest mills in Michigan, and has, we are informed, proved in every way efficient. For further information address the Stearns Manufacturing Company, Erie, Pa.

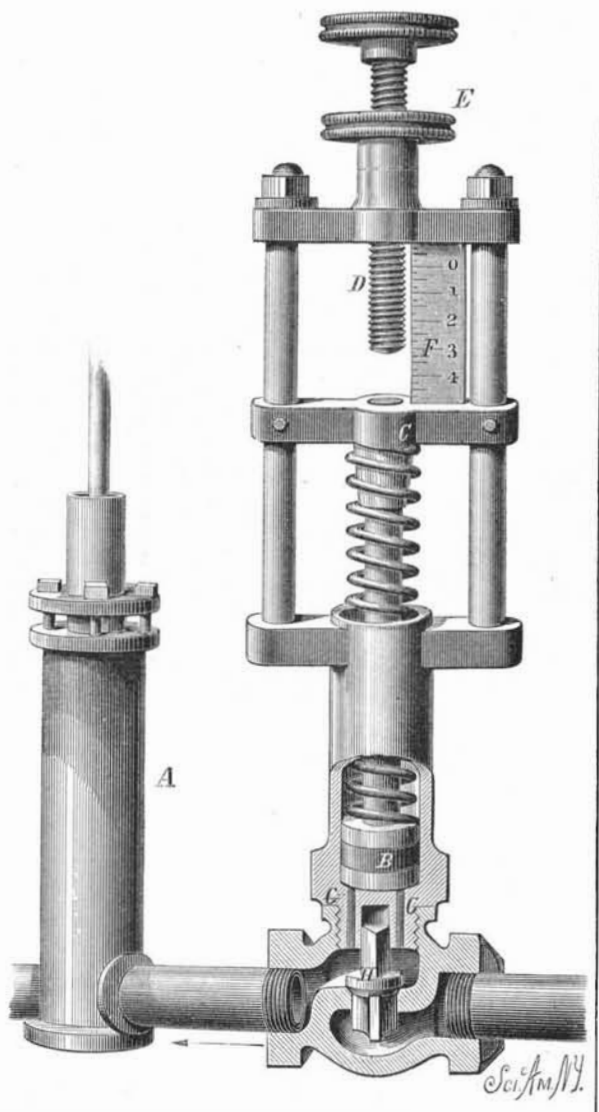


IMPROVED SAW MILL DOG.

OIL DISCOVERIES IN PENNSYLVANIA.—A singular circumstance is reported from the Holder Run oil section, in the shape of the striking of a deposit of oil which exhibits none of the impurities of petroleum when it comes from the ground, but, on the contrary, spouts from the sand in a refined condition. The oil comes from the well a pale green transparent fluid, and can be used in lamps at once. It gives a brilliant light, with no smoke or odor, and stands a fire test of 110°, a lighted match being thrown into a vessel containing the oil failing to ignite it. It deposits very little sediment.

IMPROVED FEED REGULATOR FOR BOILERS.

It is the usual practice of engine builders to make the feed pump about two or three times the theoretical size, and to regulate the supply of water to the boiler by partially closing the suction valve. A little thought will convince any engineer that this system is open to many objections. Suppose the pump, if completely filled and discharged at each stroke, to deliver twice the volume of water into the boiler that was required. Thus the suction would be closed off so that the pump would only half fill with water at each stroke. When the piunger descends and is half down it meets the water coming up, and the result is a disagreeable pounding causing much strain and wear on the connections, and a rapid destruction of the check valves. Moreover there is a tendency for air to leak into the pump through the stuffing box. This, in very high pressure engines such as are used on small boats, is a source of great annoyance and danger, as a very little air will from its elastic nature prevent the pump from working. In small boats it is also a desideratum to have a certain and definite volume of water enter the boiler at each stroke of the engine. This cannot be done with the common pump now in use. For suppose the engine is making 400 turns per minute and the valve in the suction is opened just sufficient to allow the proper volume to enter, half filling the pump. If the engine is slowed to 200, less than one half the steam is being used and twice as much water being pumped into the boiler per stroke, or fully three times as much as is required. When the engine slows down from a lack of pressure the trouble is greatly aggravated by a much larger quantity of cold water than is requisite being put into the boiler. Boat boilers, being very active and liable to quick fluctuation, require very close watching when supplied in the usual manner.



FEED REGULATOR FOR BOILERS.

Our illustration shows a very simple device which, it is claimed, obviates all the above objections. It is the invention of Hiram S. Maxim, M.E., who contrived it for use on his small and fast steam yachts. A is the ordinary form of feed pump, the discharge valve being on the left and not shown. The regulating apparatus is placed on the right between pump and suction valve. It consists of a cylinder of the same volume as that of the pump in which works the air-tight piston, B. The stem of this piston passes up through the guide piece, C, and is surrounded by a coiled spring which keeps it down. On the upper part of the device is a screw, D, which may be adjusted so as to limit the upward movement of the piston rod when the piston is raised against the action of the coiled spring. On said screw is a binding nut, E, and beside it is placed a graduated scale, F, whereby the screw may be set to limit the movement of the rod or stem at any point, as for instance at one half, one third, or one quarter the total possible travel of the piston in the cylinder. Beneath the piston are two apertures or channels, G, and between them is a recess in which plays the stem of the valve, H, which is seated in a horizontal partition in its casing as shown.

Supposing for example the screw, D, is brought down so as to prevent any motion of the piston, B. Then when the pump makes an upstroke water will be drawn through the valve, H, and the latter closing in the down stroke of the pump all the water drawn into the pump barrel will be forced on into the boiler. This is the ordinary condition of affairs with the regulating device being rendered inoperative. Now suppose the screw, D, moved up to 0, so that the piston, B, has full play. The up stroke of the pump draws in water through valve, H, as before, but on the down stroke the conditions are altogether different from before. The water will, as a matter of course, pass in the direction where it meets the least resistance, and it must either enter the boiler against the pressure or it must lift the piston, B, and enter the barrel of the regulator. Now, the strength of the coiled spring in the latter is so adjusted as to make it easier to raise the piston against it, than for the water to pass to the boiler. Hence the contents of the pump barrel will flow into the regulator barrel and fill the same, the piston rising. Consequently no water would enter the boiler, and there would simply be an oscillation of the fluid alternately from pump to regulator and regulator to pump as the latter continued in operation.

This brings us to the third condition, namely, suppose the screw, D, to be moved partially down, say to 3, as in our engraving. Obviously, then, the piston, B, will be permitted to rise only one fourth of its stroke, only one fourth of the contents of the pump barrel can therefore enter the regulator cylinder, and the remaining three fourths must go on to the boiler.

It will be clear that we have simply to adjust the screw, D, and secure it by the binding nut so that no jar can displace it, to reduce the quantity of water delivered by the pump by any desired fraction.

One very important advantage claimed for this invention is the facility with which the discharge of the pump may be ascertained. A glance at the movement of the piston rod indicates whether the pump is or is not working. Should the water supply give out the motion ceases. The contact of rod and screw makes a slight click like that of a telegraph sounder, the cessation of which would attract attention to any failure of supply. The device may be made of any size and adapted to any form of boiler.

For further particulars address H. S. Maxim, M. E., 74 Coal and Iron Exchange, New York city.

Absorption and Evaporation in Plants.

M. Vesque has recently made some researches into the relation between taking up water by the roots and evaporation by the leaves of plants. He concludes that the absorption of water by the roots is not proportional to the temperature of the leaves if these be placed in an unsaturated atmosphere. At a low temperature it increases but slowly in proportion as the temperature rises, but at a certain temperature fixed for each plant the absorption rapidly increases. It becomes stationary at a temperature maximum, which is different for different species.

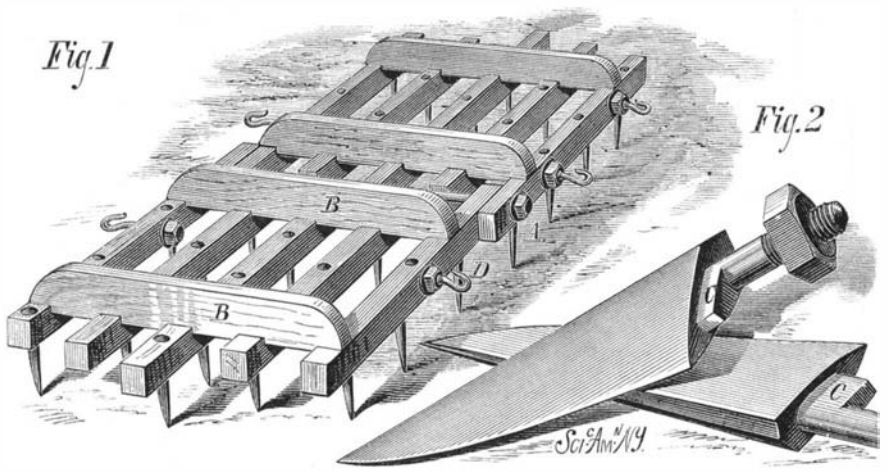
The absorption of water by the roots is independent of the temperature of the leaves, when these are in an atmosphere which is saturated, dark, and protected against heat radiations. Dark heat rays act very powerfully on the transpiration in saturated air, and have the same action on the absorption as a rise of temperature when the leaves are in a dying condition.

© 1878 SCIENTIFIC AMERICAN, INC

DOBBIN'S IMPROVED HARROW.

The advantages claimed for the improved harrow illustrated in the accompanying engravings are as follows· It is easily portable, and need not be placed upon a wagon to transport it to and from the field; the construction of the teeth enables work to be done equally well at the sides as at the middle; the parts being hinged, the harrow can be folded into small space; the teeth are especially adapted to sod ground, and work well whether the soil be rough or smooth; by removing two or three teeth for each row, three rows of corn can be cultivated at once, and this can be carried on until the plants are several inches high.

The frame is made in two sections, each consisting of five parallel crossbars with transverse pieces, as shown in Fig. 1. The sections are hinged by the long bolt, A, passing through the overlapping ends of the bars. The ends of the transverse bars, B, are rounded to adapt them to serve as runners when the harrow is turned over to enable it to be drawn from place to place. The teeth are separately shown in Fig. 2, and are made wedge-shaped so that they will cut sods, etc., clear themselves of rubbish, pass through the ground easily, and enter it to greater depth. The shanks of these teeth are passed through holes in the bars and secured by nuts. Projections, C, on said shanks prevent the teeth from turning. To the front and rear bars are attached hooks, so that the harrow may be drawn with the inclined or the straight edges of the teeth forward, as may be desired. By means of the hook, D, the draught may be applied to the lower section when the two sections are folded together.



DOBBIN'S IMPROVED HARROW.

Patented through the Scientific American Patent Agency, January 22, 1878. For further information address the inventor, Mr. Melvin M. Dobbin, Box 216, Aurora, Ill.

Fish Hatching by Steam Power.

At the meeting of the American Fish Culturists' Association, recently, Professor Milner gave an account of the process of hatching shad eggs by machinery, in operation at Havre de Grace, Md., where over eight million shad were hatched last year. The eggs to be hatched are placed in sheet iron cylinders, with wire netting bottoms, and half submerged in the river. The cylinders are suspended from the short arms of levers, and given a slow up and down movement by means of shafting carrying eccentrics acting on the long arms of the levers; the whole set in motion by a ten horse power steam engine. The engine and other machinery are carried by a large scow, anchored in the stream. The fish so hatched proved hardy, bearing transportation well, even as far as California.

Dangerous Kerosene.

At an inquest in Jersey city, a few days ago, in the case of a woman killed by the explosion of a kerosene lamp, Professor Cornwall of Princeton College testified that he examined five samples of oil that had caused explosions in different parts of the State, and all gave off inflammable vapor below 100° Fah. One sample took fire itself at 85°, one at 99°, one at 105°, one at 106°, and one at 111°, the last being better than the standard adopted by the Produce Exchange. The flashing test he believed to be the only safe guide, his observations showing that oil standing a fire test of 110° will not stand a flashing test of 100°. Any oil flashing below 100° is dangerous.

Out of fourteen oils tested in one small town only four withstood this test. The oil causing the accident in question fell 16° below the lowest safe test. It is the naphtha or benzine left in the oil by refiners or put in by retail dealers that does the mischief. At the present price of kerosene in barrels the difference in cost is less than one cent a gallon between a safe oil standing 100° flashing test and an average oil of 110° fire test, even if the naphtha removed in refining were thrown away. A retail dealer can add ten per cent of benzine to kerosene having a reasonably safe flashing point without making the oil worse than the average oil that Professor Cornwall has tested. More than half the explosions he has met with have taken place when the lamp was burning quietly.

Spontaneous Explosion of Toughened Glass.

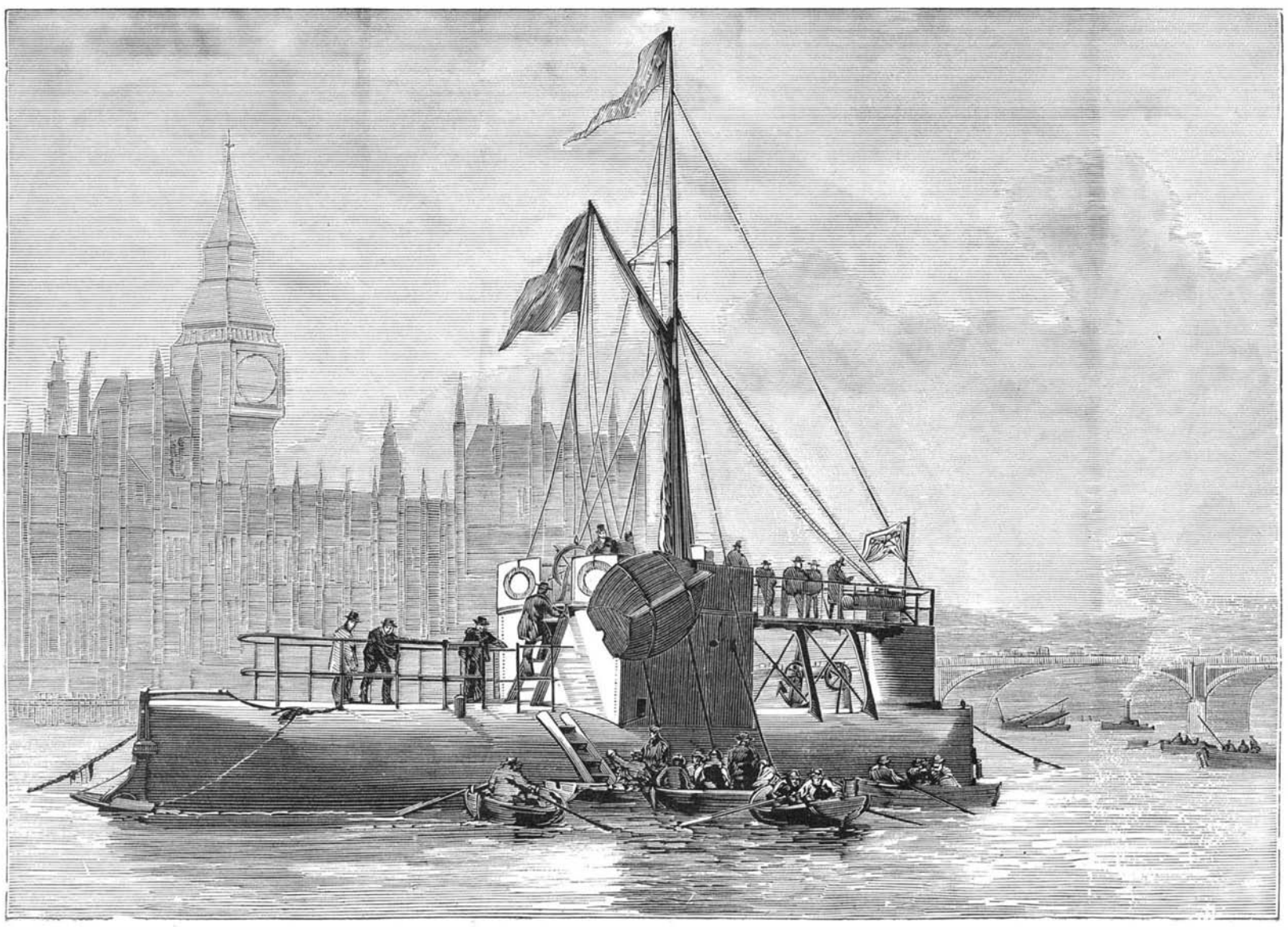
In the *Bohemia*, Professor Ricard, of Trchewan, tells the following tale:

"A child's drinking glass was bought one day, at Saaz, for about seventy kreutzers, and for six months it sustained its character of unbreakable glass. But about nine o'clock one evening in the sixth month it was used in drinking *eau sucrée*, and was then placed, with a silver spoon in it, upon a large oaken table. Suddenly I heard from my room a violent explosion like a pistol shot, and a metallic sound. I ran in, and saw the whole floor strewn with needles and splinters of glass scattered thinly and widely—and not only upon the floor, but the bed, the table, the washstand, the carpet, and the clothes hung up were covered with these shreds. I looked everywhere for the cause of this explosion, and at last remarked that the child's drinking cup was gone. The empty glass had exploded—without apparent cause, without the approach of a light, and having a spoon in it—with such extraordinary force that the whole household was frightened. I relate this story, therefore, not only for the information of chemists and natural philosophers, but also of those families who believe that in this so-called unbreakable glass they possess remarkable and unspoilable playthings or useful household goods, to show them that when such an explosion occurs it may cause not only fright but mischief."

To the foregoing the editor of the *Polytechnichen Notizblatts* adds that such explosions of toughened glass, often without any apparent cause, have been pretty frequent of late, and appear to be on the increase—a circumstance likely to prevent people from using toughened glass until the cause of this evil property has been discovered and removed by a change in the process of manufacture. The explosion is, doubtless, caused by some change in the extreme tension of the fibers of the toughened glass, and it is probable that if the tension were removed the glass would no longer be tough.

CLEOPATRA'S NEEDLE.

The Egyptian obelisk, whose stormy voyage from Egypt to England we have already chronicled, has at length safely reached the Thames and will shortly be erected in London. The history of this stone is an eventful one. It was originally hewn out of the rose-colored syenitic granite in the quarries of Syene, and transported to Heliopolis, where, with a sister shaft, it stood before the door of the Temple of the Setting Sun. In the days of Cleopatra, the monument resumed its travels and was brought to the temple of Cæsar at

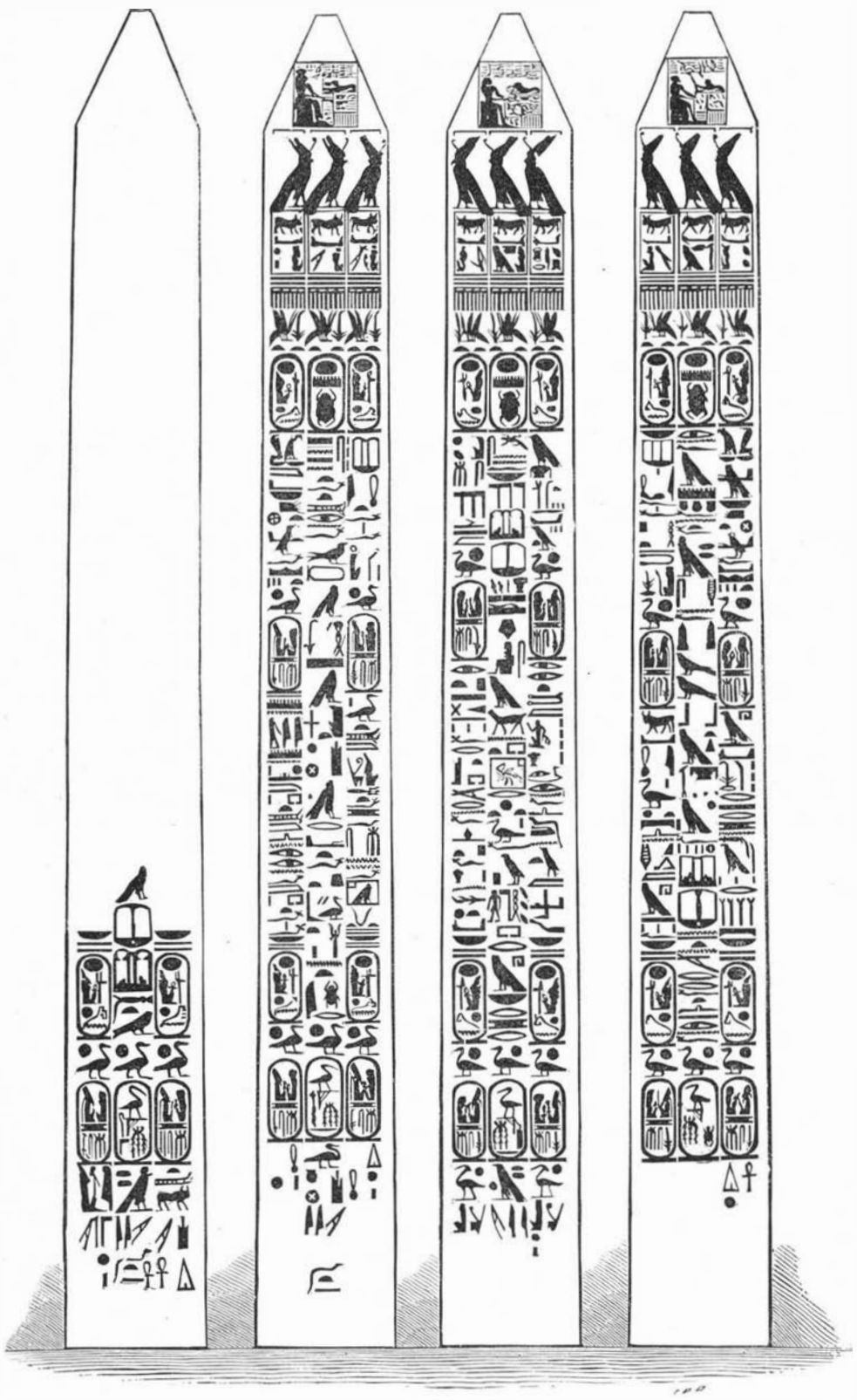


THE CYLINDER SHIP CLEOPATRA.

© 1878 SCIENTIFIC AMERICAN, INC

Alexandria. For nearly twenty centuries one of the two columns has remained standing. The other one, which is the subject of the present article, at some period not known fell down, and thus it has remained half buried in the sand until recently exhumed.

The obelisk was originally raised by an Egyptian monarch in order to record his victories over Asia and Ethiopia. The central line of hieroglyphics (all four sides are shown in the annexed engraving) contains the name and titles of the monarch, and records that the stone was erected to the god Ra, or the rising sun, and to Tum, or the setting sun, on the occasion of the Festival of Thirty Years at On or Heliopolis. It is probably one of the obelisks for which Thothmes appointed a daily offering of bread and beer, as if it were a statue or living being to be ever worshiped. The inscription states that it was capped with gold, but of course that portion has long since been stripped from it. The idea of removing this obelisk to England as a memorial of the departure of the French from Egypt was entertained at the beginning of the present century. Subscriptions were started for the purpose, and the work of removal was undertaken, but it was finally decided to abandon the attempt. In 1819 Mehemet Ali presented the stone to the British Government. Various examinations were made of it *in situ*, but nothing was done towards its removal. Finally, Mr. John Dixon, an English contractor, undertook the task; the money necessary was subscribed by private enterprise, and, as our readers are aware, the great shaft was built into a vessel and launched. The voyage to England was successfully achieved until the stormy Bay of Biscay was reached, when, during a heavy gale off Cape Finisterre, the towing vessel was obliged to abandon the obelisk craft to its fate. That fate, however, was not a descent to the sea bottom; for after drifting about for a day or two, the wandering monument was encountered and brought safely into a Spanish port by a merchant steamer. From this point it was towed to England, and the vessel in which it is inclosed now lies, as represented in our engraving, on page 199, on the smooth water of the Thames.



HIEROGLYPHICS OF CLEOPATRA'S NEEDLE.

Music for the Insane.

The power of music to calm madness has been popularly recognized, at least since David was called to harp before Saul. Just what its real value may be, however, as minister to the mind diseased, remains undetermined. Introduced as an incidental or occasional influence, music has been no stranger in our asylums for the insane; but we do not know that any systematic and repeated experiments, to discover its sanitary effect in such disorders, were ever undertaken until those were begun in our public institutions on Ward's and Blackwell's islands, at the instigation of Mr. Pattison, the pianist.

The fifth of these experiments was made a short time ago in the Women's Asylum on Blackwell's Island. At first the patients—selected cases—were submitted to the influence of music singly; afterward a general musical entertainment was given to several hundred patients in a large hall; and, finally, the hall was cleared for dancing, and a large number of the patients enjoyed an old-fashioned "break down" for half an hour. The music was both vocal and instrumental, and the effect in the main was highly satisfactory. There can be no doubt that music influences more or less powerfully almost every grade of patients, the particular effect, in any case, depending on the nature of the music and the type of the disease.

The experiments were watched by a number of physicians and other experts, whose conclusions were that, in the main, suitable music temporarily tranquilizes the violent, soothes the nervous, and makes the stolidly melancholic cheerful and chatty; and it was thought not at all improbable that these beneficial effects might be made permanent by continuous treatment adapted to the individual cases. The intention now is to repeat these entertainments as frequently as possible during the year. They will certainly make agreeable breaks in the wretched life of the inmates of our public asylums, and afford them momentary enjoyment, even if they prove to have no lasting sanitary effect.

Homeopathic Insurance.

The mortality experience of the Homeopathic Mutual Life Insurance Company of New York, in the nine and a half years from July 18, 1868, to December 31, 1877, shows as follows: Policies issued to homeopaths, 7,927—deaths, 84; policies issued to non-homeopaths, 2,258—deaths, 66. This presents a homeopathic death rate of 1·060 per cent, against an allopathic death rate of 2·923—the latter being thus 175 per cent higher than the former. Data as meager as these, and without being accompanied with expression of associated conditions, are, of course, no basis for a conclusive opinion; but, so far as the data reach, they assert 2¾ allopathic deaths to 1 homeopathic, under presumed equal conditions of ailment. To all of which the old-school physician will answer, *Credat Judæus Apella, non ego;* and in support of the denial of the non-Hahnemannian, in one respect, is the fact that many life offices, limiting themselves to any particular school of medical treatment, will show about as many different death records as they themselves number. It is, however, creditable to the faith and intelligence of the followers of the great innovator that they seek a measurement of experience and court the testimony of statistics. Any sufficient comparison must, however, be made upon the basis of like numbers of persons of even ages afflicted with like diseases. It is a comparison and a decision which life insurance will one day make.—*American Exchange and Review.*

EXPLOSIVE DUST.—A correspondent of *Nature* writes: "There have been three explosions of malt dust in our mill within four years, not due to any carelessness in allowing a flame to approach the impalpable dust, but ignited by a spark from a piece of flint passing through the steel rollers, or from excessive friction in some part of the wood fittings. Such explosions are not uncommon."

New Mechanical Inventions.

Mr. R. M. Lamson, of Vevay, Ind., has invented a new Pitman Connection, which consists of a bushing fitted to a square aperture (in the knife head of a mowing machine, or in corresponding parts of other machinery), and bored to receive a cylindrical thimble, which is fitted to the square shank of the pitman.

An improved Squeezing Machine, for the use of bleachers, dyers, calico printers, etc., has been patented by Mr. William Birch, of Salford, England. The materials employed for the rollers of such machines are generally of wood, rubber, or similar material, and wear out rapidly. The inventor makes the rollers of metal, and to compensate for the absence of the flexibility possessed by the materials commonly used, contracts both the fabric to be squeezed and the face of the rollers into the narrowest possible limits, the rollers thus taking the form of disks, and the layer of material becoming correspondingly thicker. To confine the latter, one of the rollers is provided with flanges which overlap the other roller.

Mr. Joseph Metais, of Chippewa Falls, Wis., has invented an improved Washing Machine, in which the new feature covered by patent is the mode of regulating the discharge from the machine. At the bottom of the suds box is an aperture in which fits a plug carried by an arm beneath the box. This arm is attached to a shaft, and the latter is operated by a lever which extends upward at the side of the machine. A spring catch locks this lever securely in place.

The object of an invention patented by Mr. F. C. Frost, of Anoka, Minn., is to furnish an improved device for changing the speed of the Feed for Circular Saw Mills, even during full run when desired, and to obviate the necessity of stopping to shift belts on different pulleys. Friction rollers of different sizes, mounted in a sliding frame, are so arranged that one or the other of these friction rollers may be thrown in and out of gear with the friction wheel of the feed shaft, by means of a hand lever.

In a new Washing Machine, invented by Mr. C. H. Horne, of Berwick, Maine, the improvement consists in combining with a vibrating dasher two hinged vibrating boards located at the ends of the tub and connected by a rod let into a groove in one side of the tub. The object is to cause the fabrics to turn over after each blow given to them by the dasher, thus causing them to present new surfaces at each stroke. This is effected by the vibrating boards added.

Mr. E. J. Northrup, of Warren, Pa., has invented a Casing Head for Oil Wells, which is so constructed as to prevent overflow of the oil and thus enable the operation of boring to be continued after oil has been reached. The drill is worked by a cable, which slides through a packing ring in the head. When oil is reached it is prevented from escaping around the cable by the packing ring, and is conveyed away by pipes screwed into the head below the packing. When the well is not flowing the packing ring is loosened and the cable moves freely through it. The various parts of the head are arranged in an original manner and with a view to a complete saving of oil, the adjustment of the packing being effected by screwing up or down a sleeve in the upper part of the head.

An improved Lubricator, invented by Mr. G. H. Flower, of Chicago, Ill., has an upright stand pipe which receives steam from the steam pipe, and an oil-conducting pipe which leads through the reservoir partly into the steam pipe. Connected with the reservoir, by the conducting pipe, is an indicator, consisting of a glass tube contained by a suitable support. The glass tube contains water, but its position is lower than the column of oil in the conducting pipe, so that the pressure of the water is overbalanced by it; and the oil, as it escapes in drops from the nozzle of the conducting pipe, may be seen rising through the water to the valve.

Mr. S. B. Elzey, of Hope, Ark., has invented an improved Pump, having two cylinders connected by a single passage, in which there are two suction valves and one discharge valve, which is common to both cylinders. There is also an

© 1878 SCIENTIFIC AMERICAN, INC

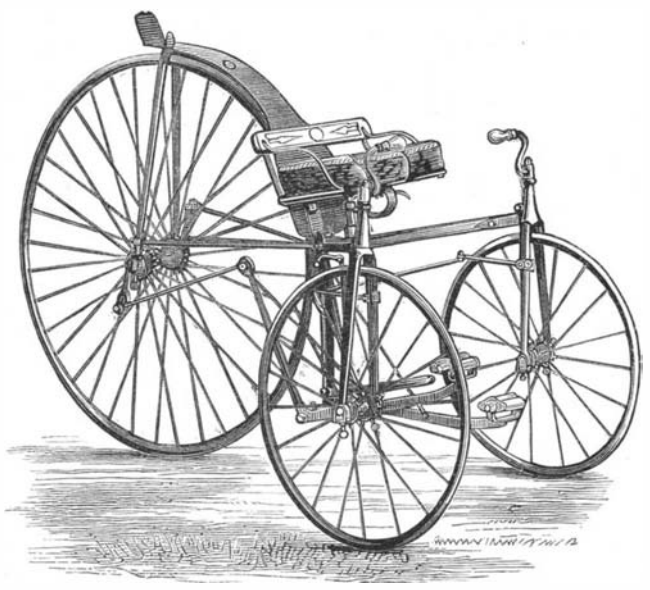
arrangement of levers for opening the suction valves, to permit the water contained in the cylinder and discharge pipe to escape, so as to prevent freezing and stagnation in the pump.

IMPROVED TRICYCLE.

The tricycle is a machine that is likely to meet with a ready reception from those who desire to avoid the risks of a bicycle, and also from ladies who would wish to share in healthy out-of-door exercise. The specimen we now illustrate is that built by Messrs. Singer & Co., of Coventry, England, and has several special features of value. In the arrangement of the wheels, the driving wheel is central with the weight, and the two forward carrying wheels are equally spaced on either side of the rider. Where a side driving wheel is used, the weight cannot be employed with advantage, and the other side carrying wheel acts rather as a drag upon the tricycle.

The frame, light but strong, is formed by a fork in front, carrying the pivots and forks for the two forward wheels. After uniting, it arches over the main driving wheel, where it carries the fork for that wheel, which fork is also stayed to the main fore carriage fork The seat may be either a saddle or a cushioned seat, shifted at will by unscrewing bolts and nuts in the end of the bent spring. The other end of the bent spring is attached to a vertical spindle passing through a socket in the forward forging. The height of the spindle may be adjusted by a set screw, so that the seat or saddle may be fixed to suit the rider's convenience in each case, so as to give the freest and most comfortable play to the legs. The position is arranged for the saddle, to resemble, as far as possible, that of a bicycle rider. The driving gear is given by two treadles on the end of two levers, which are made into bell cranks by a stayed arm at right angles to the treadle arms. These bell cranks give an effective pull upon the cranks of the main driving wheel. A splash board is fixed to the main rib passing round the main driving wheel, so as to protect the rider. The steering gear is a powerful and effective arrangement on the two forward wheels; the spindles are carried up through the sockets, and fitted with handles at the upper ends. The two forks of the two leading wheels have arms riveted to them, and these are connected by a rod, so that the pair of wheels must turn together and may be moved by either handle. A powerful foot brake is added to press upon the tire of the back wheel.

The special advantages of this tricycle may be summed up as follows: (1.) Safety; the position of the rider is exactly between the three wheels, and therefore in the most stable position to resist overturn. (2.) Direct action; that is, the driving is centrally with the position of the rider, and also centrally with the driven wheel. (3.) Power; the arrangement of levers is most effective for mechanical advantage. (4.) Efficient steering gear. (5.) Adjustable seat for any size of rider. (6.) A good powerful foot brake upon the large wheel. (7.) The alternative use of either a cushioned seat or saddle, for a lady or gentleman. This is certainly a formidable list of advantages, but they are confirmed by the construction of the machine, which, at the same time, is light and elegant. —*Iron.*



IMPROVED TRICYCLE.

SEA BEANS.

Quite an important industry has lately sprung up in Florida in the preparation and mounting, as watch charms, sleeve buttons, ear drops, etc., what are commonly known as Florida sea beans. At St. Augustine the United States Government has a sea bean factory, where a large number of Indian prisoners are employed polishing these pretty and curious products—of the sea, it is popularly supposed.

"I can get no clew to their origin," said an intelligent Florida tourist the other day. "They are said to come from the sea. Do they grow there?" Another gentleman, who had been connected with a popular winter resort in Nassau, was quite positive that they were a marine product. The encyclopedias are silent with regard to them. Tourists and tourists' books, guide books, and similar sources of information fail to explain their origin. They are for sale in all the fancy stores and notion shops, and at all the street corners by curbstone dealers in cheap jewelry. Everybody knows what they are; but all that is popularly known about their origin is that they are picked up along the Florida beaches after storms, and that large quantities of them are brought from the Bahamas, where they are likewise washed up from the sea.

On splitting one open it was at once apparent that it could not have grown in the sea; no marine plant bears dicotyledonous seeds. It was clearly a bean of some sort, and if they did not grow along the beaches where or near where they are picked up, they must have grown elsewhere, and possibly may have been floated by the Gulf Stream from the South. Thither we sought for them; and to save other inquirers the labor of identifying them we will say that after much research we were able to trace them to their native soil.

They are well known in the West Indies, where they are variously called from their appearance ox eyes and ass's eyes. The earliest description of them and the tree which bears them appears in the second volume of the "Natural History of Jamaica," by Hans Sloane. The tree was found by him abundantly on low ground "by the river's side under the town and on the Red Hills very plentifully." His description of the tree, which he calls *Cytissus arboreus*, is quaint enough: "This tree has several trunks, each as big as one's leg, rising together, covered with smooth cinnamon colored bark, straight, eight or nine feet high, the branches rising upright, all round about beset with leaves coming out at an inch's interval, three always together, all taking their origin at the end of an inch-long, green, common footstalk," and so on to the end without a stop.

There appear to be several allied trees bearing the different beans sold under the common name. Linnæus describes the ox eye tree as *Dolichos urens*. De Candolle's name is *Mucena urens*. In his splendid "Flora des Antilles," De Tussæ figures life size and beautifully colored the stem, leaf, flower, and fruit pod of the tree which yields the larger and handsomer beans, and describes the tree as *Negretia urens*. In many parts of the West Indies the superstitious carry ox eyes in their pockets, as like classes here carry buck eyes or horse chestnuts, and for the same purpose.

New Inventions.

An improved Picket Pin, which the inventor, Mr. P. J. Tweed, of Blair, Neb., claims cannot be pulled from the ground, and around which the tedder rope cannot be wound or twisted, has recently been patented. A corkscrew shank gives a firm bearing in the ground, and the rope is swiveled to a washer in a hollow head having a central aperture in its top.

Mr. M. H. Smith, of Ithaca, N. Y., has invented an improved Device for Attaching Harness to the Shafts of hose trucks, buggies, and other vehicles drawn by one horse, the operation being accomplished by simply dropping the thills. The apparatus consists of a flanged and spring cushioned socket plate, which is pivoted to a plate clamped to the shaft, and carried, by the lowering of the shaft, over a recessed button on a side plate of the harness, so that a spring catch on the socket plate locks to the button of the side plate.

An improved Temporary Binder, or file for magazines, letters, papers, etc., has been patented by Mr. H. E. Thompson, Jr., of Pittsfield, Mass. To the back is secured a semi-tubular plate having semi-circular end plates. The edges of the long plate are bent over to form tubes, one of which serves as a hinge for two needle arms, and the other is intended as a receptacle for the binding rod when the file is full. The binding rod is adjustable in tubes formed upon the inner side of the end plates. This file may be made right-handed, so that the paper last filed may appear first, or left-handed, so that the papers follow each other in the order of filing.

A new Carpet Fastening, invented by Mr. Warren Aldrich, of Lowell, Mass., consists of a toothed strip, which is guided vertically below the mop board of a room or along the risers of stairs, and raised or lowered by suitable lever mechanism, so as to release or take hold of the carpet.

In an improved Side Bar Wagon, invented by Mr. D. F. Cooper, of New York city, the essential features are two parallel rubber-cushioned springs, which extend from the side bars to blocks on the under side of the body, to which each spring is fastened at two points, being cushioned at the intermediate points.

Mr. E. B. Beer, of Sussex, Canada, has made certain improvements in Targets, which consist, first, in attaching the target rigidly to a lever pivoted to a fixed frame in such a manner that it may be operated to swing the target out of its normal position, to enable it to be conveniently patched; and secondly, in constructing the supporting frame and lever arms or standards of beveled or tapering pieces, so that they may oppose as small a surface to the balls as possible.

An improvement in Wagon Gear and Brakes has been made by Mr. J. J. Pennington, of Henryville, Tenn. This invention is designed to furnish an arrangement by which wheels of equal size may be used, following each other in the same track, and the brakes be automatically applied to the hind wheels, or all the wheels, on descending ground.

A Book Rack for Church Pews has been invented by Mr. A. R. Sherman, of Natick, R. I. It is so constructed as to hold the books pressed shut, and at the same time allow them to be readily put into or taken out of the rack.

Mr. Albert Gemünder, of Columbus, O., has invented an Organ Pipe provided at the side and above its mouth with one or more openings, and having a corresponding valve or valves, arranged to be operated by suitable mechanism, so that one or a series of tones differing from the natural tone or pitch of the pipe may be produced at the option of the performer.

Mr. C. N. Buzzell, of Monroe, Me., has improved upon common Oven Shelves by pivoting them, making the free ends arc-shaped, and extending the latter as an arm, which serves as a partial support for dishes too large to be supported by the shelf alone. When the oven opens only on one side a single shelf is used; and when it has two doors two shelves are employed, swinging in opposite directions.

In a Ruling Pen, invented by Mr. J. C. Moss, of New York city, a graduated index is added, so that the blades of the pen may be quickly set to correspond with the width of any line which it is desired to rule.

In a new Car Coupling, the draw head has horizontal side slots, with end recesses or seats for the pivots of an adjustable guide frame, so as to extend the coupling link beyond the mouth of the draw head or withdraw it. This is an improvement upon a former patent issued to Mr. D. R. Halter, of Lee's Cross Roads, Pa.

An improved Rain Gauge has been patented by Messrs. Lawrence Dunne and E. T. Richmond, of Morgantown, W. Va. The object is to provide a gauge which will automatically fill and discharge, and will continuously and accurately record, both at the instrument and at a distant point if desired, the amount of rain fall. This gauge has two cylinders containing floats, which are connected by chains running over a chain wheel controlling a spring-actuated train of gearing that operates the supply and discharge valves of the cylinders, and also controls electrical recording apparatus. There is also a device for warming the apparatus, for melting snow or hail.

Mr. C. D. Hyde, of Pitcher, N. Y., has invented an improved Folding Chair, formed by the combination of two pairs of legs, pivoted side bars, seat and back, in such manner that the back may be turned down upon the seat, so that the chair may be slipped beneath a table, or all the pivoted parts may be folded together compactly.

Mr. M. J. Duffee, of Mobile, Ala., has invented an improved Envelope, which he claims cannot be opened after it is once sealed, and be reclosed and sealed again, without being torn or so much injured as to exhibit evidence of such opening. This is effected by subdividing the flaps into a number of overlapping and underlapping parts, which interlock.

A Self-tamping Oil Well Torpedo has been invented by Mr. G. S. Vaughn, of Franklin, Pa. It consists of a cylindrical shell, the upper portion of which is made of an outer and inner cylinder, and filled with plaster of Paris, sand, or other tamping material. A small central tube passes through the shell, and extends downward into the lower part, or torpedo proper, which contains nitro-glycerin. At the bottom of the central tube is an anvil, and side perforations admit the nitro-glycerin. A weighted drop rod having percussion caps at both ends is attached by a ferrule, is guided in the central tube, and explodes the shell by being dropped down upon the anvil.

A Life Boat, lately patented by Mr. G. F. Sievern, of Brooklyn, N. Y., is designed especially for use in a high surf. A double cone buoy, pivoted at one end to the bottom of the boat, projects forward, so as to take the water first and cause the boat to ride easily, and also to divide the wave and prevent breakers from falling on the body of the boat. The buoy is supported by a boom and braced laterally by stays.

Mr. J. M. Lasater, of Manchester, Tenn., has made an improvement in Hames and Sectional Rocking Collars, relating to the construction and arrangement of the parts by which the bearing pads are attached to the hames.

Messrs. J. D. Fahnestock and L. A. Powell, of Aurora, Ill., have patented a process of forming a Dental Plate and Teeth in one homogeneous piece of porcelain, by first taking a pattern of plate and teeth directly from the mouth, and from this forming a sectional mould; then packing this mould with plastic porcelain and subjecting it to pressure, the product being finished in the usual manner.

Mr. T. J. Connell, of Merrimac, Mass., has invented an improved Paint Brush Bridle, composed of sections pivoted at the lower end and held at the upper end by a cup ferrule. The lower end of the bridle is contracted and flattened into an elliptical shape. To the ferrule is attached a long clasping tube, which receives the handle.

A Safety Window-Cleaning Chair has been invented by Mrs. Henry Dormitzer, of New York city. It may be temporarily attached to any window, furnishes a secure support, and may be compactly folded when not in use. It consists of a combination of a platform, folding guards, and supports, suitably arranged.

THE Bethell system of preserving railway ties by creosoting, used in England, is said to increase the life of the ties to 20 or 30 years.

© 1878 SCIENTIFIC AMERICAN, INC

NOTES OF PATENT OFFICE DECISIONS.

A motion was made by Hardy to renew a forfeited application more than two years after the date of allowance of the original application. Such a case falls under the requirements of section 4897 of the revised statutes, which provides that where an applicant fails to make payment of his final fee within six months from the date upon which the application was passed and allowed, and notice thereof was sent to the applicant, or his agent, he shall have the right to make an application for a patent within two years after the allowance of the original application.

The origin of this section dates as far back as 1863. In the Annual Report of the Commissioner of Patents for 1861, it was represented that the Patent Office was suffering disadvantageously by the postponement of the payment of a great many final fees, and Congress, presumably acting on such representation, passed an act (March 3, 1863) containing a provision that if the final fee for a patent was not paid within six months thereafter, the patent should be withheld, "and the invention therein described should become public property as against the applicant therefor." This act was amended by the act of June 25, 1864, which extended the privilege of renewing the patent within six months to any person having an interest in the invention, whether as an inventor or assignee. The act of 1863 was again specially amended by the act of March, 1865, which for the first time extended the privilege of renewing the application to two years after the date of the allowance of the original application, and the language of the section of that act relating to this matter was incorporated without change into the act of 1870. But in the act of 1870, that provision of the act of 1863, in force until 1870, enacting that the invention, as against the applicant, should become public property, was omitted.

The cases under this section 4897 must be distinguished from the abandoned applications covered by section 4894. This latter section requires that the applications shall be completed and prepared for examination within two years after the filing of the application, or, in default or failure of the applicant to prosecute the same, the application is to be regarded as abandoned, unless it be shown to the satisfaction of the Commissioner that such delay was unavoidable. This requirement compelling applicants to prosecute their applications within two years, or else to show to the satisfaction of the Commissioner that such delay was unavoidable, was enacted in March 2, 1861, two years prior to the act of 1863, and was in force cotemporaneously therewith until 1870.

There is an injustice apparently resulting from this discrimination which the law makes between the applications which have not been prosecuted within two years after an action by the Patent Office and applications which have been prosecuted with diligence and passed to issue. In the former case, the applicant may keep his case alive for a number of years; or, after the application has become abandoned by operation of law, he may renew it by showing that his delay was unavoidable; or he may discard the old application altogether and file a new one in its place; whereas the applicant or owner of the forfeited application —an application which has passed the ordeal of examination and been deemed worthy of a patent—is debarred from renewing the same at all, or from showing unavoidable delay, after the expiration of two years subsequent to the allowance of the original application. This apparently unjust discrimination, however, has existed in the law for fourteen years. If it had been the design of the legislature to have put them all on the same footing, it certainly would not have passed a special act making the distinction. But it is a maxim of interpretation that it is not to be presumed that the legislature intended any part of a statute to be without meaning. To regard forfeited applications on the same footing as incomplete and abandoned applications, and allow a new application to be filed, or the delay explained by affidavits, however equitable the construction, would remove the distinction between the two classes of cases, and leave the imperative language of section 4897 without any meaning whatever. The Commissioner therefore denies the motion to renew Hardy's application.

The Tolles Amplifier.

Several correspondents have called our attention to a statement made by an exchange and reprinted in the SCIENTIFIC AMERICAN of March 9, 1878, regarding the merit and novelty of a microscopical instrument known as Tolles' "amplifier," an accessory apparatus for increasing the power of the object glass by placing a lens between it and the eye piece. In the article referred to, the idea was conveyed, by implication, that this system was of recent introduction, and its value was questioned. In response to our call for further information regarding the matter we have a number of communications in which the writers describe their personal experience with the amplifier, and offer strong evidence in its favor.

Mr. Charles Stodder, of Boston, forwards an interesting series of microscopic photographs taken with the assistance of the Tolles amplifier, the subjects being human blood and that of snakes and fishes, with other mountings, and the appearance of these photographs confirms his favorable opinion. Mr. Stodder states that the amplifier has been in use for over twenty years, and remarks that he has a periodical of 1859 which contains an advertisement of it.

Dr. J. B. Treadwell writes that he has used the instrument for several years, and sums up the general result of his experience as follows: "It doubles the power without impairing the definition. The advantage of obtaining increased power by this means over that of securing the same end by the use of shorter eye pieces lies in the fact that with the former method there is vastly better light than with the latter. For instance, the light obtained by the use of the amplifier and a one inch eye piece is as good as that obtained by the use of a three fourths inch eye piece without the amplifier, the amplification in the former case being much greater and the definition fully as good. With some objectives the amplifier gives a flatness of field not obtainable without it."

Brick Machines and their Capacities.

Gen. Q. A. Gillmore, in his report as a judge upon the brick machinery at the Centennial Exposition, prefaces his descriptions of the various machines with a classification, the essential points of which, as we give them below, will perhaps serve as a guide to the many correspondents who ask us as to the particular kind of apparatus suitable to such and such material. He distinguishes four classes, reference being had to the humidity and condition of the clay, as follows, namely: 1. Dry clay machines; 2. Crude or moist clay machines; 3. Tempered clay machines; and 4. Slush or mud machines.

In the first, clay is first dried, then crushed or granulated by rollers, and filled into brick moulds by hand, or by some device of filler boxes or graduated measures operated automatically. It is finally rendered compact by tamping, or by one or more applications of steady pressure. The moulds are usually filled to excess, and the bricks on emerging are shaved down to proper thickness by sizing knives. The objections to bricks thus made are that the difficulty of filling the moulds alike so as to produce bricks of uniform density, and the absence of moisture, are likely to cause imperfect cohesion during the moulding process or incomplete fusion in the kiln. General Gillmore also states that dry clay bricks possess, in an inferior degree, the power to withstand the disintegrating effects of the weather, especially in high latitudes.

In crude or moist clay machines, the clay is worked in its natural state as it comes from the bed. Disintegration, as before, is followed by pressure into moulds, and finish is given by the knife or smoothing plate. These bricks are more plastic than those of dry clay, and can generally be hand pressed if desired, immediately after they are delivered from the machine.

Tempered clay machines are usually the cheapest, though there are exceptions to this rule. The usual device is a pug mill, in which spiral arms mix the material while cutting it, and at the same time push it forward to the end of the cylinder, where it receives compression either by being forced through a contracted opening or die, issuing therefrom in the form of a continuous bar, which is afterwards cut up into bricks, or by being fed and pressed into moulds. As the expressed bar has a uniform cross section, a full set of dies of different forms will enable a single machine to produce in turn solid, perforated, or cornice bricks, floor and drain tiles, and other forms.

The slush or mud machines work only to advantage upon very soft and highly tempered clay, and no opinion is expressed upon them in the report under review.

The various machines exhibited at the Centennial are described in turn, and of these the principal features and capacities are stated as follows: Garretson's machine compresses dry clay by wooden iron shod rammers. Small power is required to run it, and the quoted capacity is 18,000 bricks per 10 hours. Morand's machine tempers the clay in two pug mills, and forms and presses the clay in a horizontal revolving mould table. Hand pressing and drying immediately follows. The bricks possess a high degree of homogeneity and plasticity, and are produced at the rate of from 22,000 to 24,000 per 10 hours' average work. Chambers' machine pugs the clay and forces it into and through a die, in which the round bar is reduced to one of rectangular section. The cutting device is a thin blade of steel secured radially to the periphery of a wheel. After the bricks are cut they are conveyed by an endless belt to a sanding machine. The two sizes of the machine respectively produce from 25,000 to 35,000 and 15,000 to 25,000 bricks per 10 hours. Tiffany's machine has the novel feature of two two-bladed screws behind the die, revolving in opposite directions. The issuing bar is cut by wires. The maximum production is 14,000 to 15,000 bricks in 10 hours. The Durand & Marais machine (French) has a horizontal plunger operated by a revolving cam, which compresses the material into a die, making one brick at each revolution. It works at its best in partially dry material, such as clay directly from the bank, which has been disintegrated between rollers. It does not produce a plastic brick. The capacity is from 9,000 to 10,000 bricks in 10 hours. The Ichlickeysen (German) machine consists of a horizontal pugging mill with double driving gear, surmounted by a water box for moistening the clay, a die, and a cutting table. The cutting rack moves to and from the die on wheels instead of on rockers, as in the Tiffany machine. The largest size machine driven by a 20 horse engine is capable of producing about 50,000 bricks per 10 hours.

The Imperial brick machine we illustrated quite recently. It has a horizontal pug mill, and the moulds are placed in a concentric circle on the vertical wheel, whence they pass to an endless belt. The average speed is quoted as five revolutions of the mould wheel per minute, producing 24,000 stiff plastic well moulded bricks in 10 hours. The principal feature of the Gregg impact machine is a horizontal rotating mould wheel, containing near its perimeter 32 brick moulds, divided into eight groups. The moulds have movable bottoms, and the tempered clay is compacted on them by heavy stampers delivering blows. At 1¼ revolution of the mould wheel per minute, and with a 15 horse power engine, 25,000 bricks are made per 10 hours. The Carnell machine has an upright pug mill, from which the clay is forced to a segmental false bottom, in which a cam forces the clay out into a mould, the bar being cut by thin steel blades. The rate of production is from 18,000 to 20,000 bricks per 10 hours. The Gregg combination machine consists of a horizontal revolving mould table made of cast iron, containing a number of moulds near the perimeter, into which the clay is fed in succession. Pressure is applied by plungers from below, and each brick receives three compressions. With an engine of 1 horse power, and 8 moulds in the table, 10,000 bricks can be produced in 10 hours. The Excelsior machine has two sets of moulds fixed in an alternating carriage that passes under a feeder, which fills the moulds with clay; and these pass and repass under a wheel, which imparts to the brick two downward pressures. Pistons attached to the mould bottom give the bricks an upward pressure, and afterward lift them from the moulds. The productive capacity is quoted at 30,000 bricks per 10 hours. Gregg's triple pressure machine has an intermittently revolving mould table, with which are combined devices for filling the moulds with clay, for compacting the clay by pressure from above and below, for compensating for unequal filling of the moulds by yielding plungers, which impress upon the sides of the brick recesses with depths varying with the quantity of clay in the mould, and finally, for expelling the bricks upward. Two revolutions of the mould table per minute yield 38,400 bricks per 10 hours. Aiken's machine expresses a bar, which is cut up by wires. The average productive capacity is 20,000 bricks per 10 hours.

Astronomy and the Calendar.

Professor D.G. Eaton, of the Packer Institute, Brooklyn, N. Y., lately delivered a lecture in that city on the above subject:

There are three great natural units necessary to the measurement of time. These units are found in the movement of the celestial bodies. The first is the revolution of the earth upon its axis, which measures day and night. This is the foundation of all measurement of time. The rising and setting of the sun is not uniform, but the time of the rising and setting of a star, such as Sirius, which may be seen near the meridian, is the same throughout all ages. It was the same a thousand years ago, and will be the same a thousand years hence. The other natural units of time are the month and year. Such an adjustment of the civil to the natural year as shall cause the perpetual recurrence of the seasons upon the same month is what constitutes the calendar. The artificial units of time are the week, hour, minute, and second. The account of the origin of the week can be found nowhere except in the books of Moses, though it is a division of time that was known to all the civilized nations of antiquity. It was not, however, until after the time of the Emperor Theodosius, that it was introduced among the Romans. The lecturer at this point gave an explanation of the way in which the days of the week were named by the ancient Egyptians and renamed by the Saxons. He also gave an account of the confusion which was caused in the Roman calendar by the vanity of the Emperor Augustus, who, after having the eighth month of the year named after himself, caused another day to be added to the number which it contained before, that the month of July (named after Julius Cæsar) should not exceed it in length. To regain the balance of days in each month, one day was taken from both September and November. English jealousy of the Papal power also caused confusion in the uniformity of the calendar by hesitating for more than two hundred years to accept the change in the old style of reckoning recommended by Pope Gregory and accepted at once by all Catholic countries. It was in 1752 that the new style was adopted in England by act of Parliament, and it has not yet been introduced into the Russian Empire. The motive which induced Pope Gregory to make this important change, which for a long time created so much confusion, was merely to regulate the recurrence of Easter Sunday. Though the motive was apparently of such slight importance, yet the result has been of great good to mankind. It is still a matter of difficulty for chronologists to settle the date of events which occurred in the remote past, and their task has not been lightened by the changes made in the calendar by some of the Roman emperors and the pontiffs of the Catholic Church. Professor Eaton's lecture was illustrated by off-hand sketches on the blackboard.

Limestone Bearings.

Mr. James A. Goodrich, of Moravia, N. Y., sends us an account of a waterwheel at that place, which was in constant use to furnish power for a grist mill for about 50 years. He describes it as a heavy, overshot wheel, 24 feet in diameter, on a wooden shaft, with cast iron journals resting on boxes of the Moravia limestone. At intervals of about 12 years the shaft would become rotten and have to be replaced, but the old wing gudgeons, journals, and limestone boxes were retained. The bearings were lubricated with tallow. Our correspondent states that notwithstanding this long service the only perceptible effect on the journals and boxes was a fine polish, without appreciable wear, and that the arrangement was apparently good for ages at the time the old wheel was taken down to give place to a modern turbine.

© 1878 SCIENTIFIC AMERICAN, INC

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line.

Mechanical Working Drawings a Specialty. Pemberton & Scott, 37 Park Row, room 30.

Portable and Stationary Engines; Boilers of all kinds; 45 Cortlandt St., N. Y. Erie City Iron Works, Erie, Pa.

Gold after crushed, separately. Joshua Limestone-ore being divided Address Davis ville, Pa.

Boilers & Engines cheap. Lovegrove & Co., Phila., Pa.

Alcott's Turbine received the Centennial Medal.

Vertical Scientific Grain Mills. A.W.Straub & Co.,Phila.

35 ft. Bement & Son Lathe; 8 ft. over bed; turns 16 ft.; self-acting carriage. F. M. Swegan, 287 Water St.

$8.—Morton's Number One Scroll Saw; stand, treadle motion, bevel table, etc. Send for circular. J.D.Foot, 22 Platt St., N. Y.

Colorless Lacquer. H. H. Hempler, Washington, D.C.

Wanted.—Hydraulic Pump, duplex or single, fill a cylinder 15 in. diameter, 20 ft. a minute, 500 lbs. pressure. Hinckley, 321 Dartmouth St., Boston, Mass.

For Sale.—Patent on an article of general utility; original and attractive. Box 539, Pittsburgh, Pa.

Wanted.—Addresses of Lamp Burner and Camp Chair Manufacturers. C. M. Lungren, 708 Lexington St., Baltimore, Md.

For Small Engine Castings, address Wm. D. Rich, 123 Exchange Place, Philadelphia, Pa.

Union Eyelet Company, Providence, R. I., Manufacturers of Patented Novelties.

A rare opportunity for a Moulder or Machinist with a small capital to invest in a good business. For particulars, apply to or address W. B. McKeldin, Athens, E. Tenn.

An American gentleman, established over 18 years in Paris, wishes to develop in Europe some American patent or special industry. Best references given and required. Address J. Getz, 5 Petit Carreau Paris, France.

Foundry and Machine Shop for sale. Now running and in good order. For particulars address Cofran & Bromich, Topeka, Kansas.

Wanted.—2d hand Fan for Cupola. E.L.Black,Gann,O.

Entire outfit of Nail Mill, 4, 6, 8, and 10 p., costing over $3,000, we offer for $650 to close an account. Apply quick, must be sold. Forsaith & Co., Manchester, N. H.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Self-Feeding Upright Drilling Machine, of superior construction; drills holes from ⅛ to ¾ inch in diameter. Pratt & Whitney Company, Hartford, Conn.

Lansdell's Steam Siphon pumps sandy and gritty water as easily as clean. Leng & Ogden, 212 Pearl St., N.Y.

Machine Cut Brass Gear Wheels for Models, etc. (New List.) D. Gilbert & Son., 212 Chester St., Phila., Pa.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Bolt Forging Machine & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use proves them stronger and more durable than wrought iron. See advertisement, page 206.

Galvanized Iron Cornice Machines.—The most Improved, Straight and Circular. Prices reduced. Calvin Carr, Cleveland, O., & Hewes Machine Wks.,Newark,N.J.

For the best Bone Mill and Mineral Crushing Machines—five sizes, great variety of work—address Baugh & Sons, Philadelphia, Pa.

Best Turbine Water Wheel, Alcott's, Mt. Holly, N. J.

Wanted.—A first-class business man with $10,000 to invest, and capable of assuming the general management of a Machine Shop and Foundry in Western Canada. Shop now in operation; connections first-class; and security unquestionable. F.W.Glen, Oshawa, Ontario.

For Town and Village use, comb'd Hand Fire Engine & Hose Carriage,$350. Forsaith & Co., Manchester,N.H.

The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See ad. back page.

Friction Clutches warranted to drive Circular Log Saws direct on the arbor; Upright Mill Spindles, which can be stopped instantly; Safety Elevators, and Hoisting Machinery. D. Frisbie & Co., New Haven, Conn.

Sperm Oil, Pure. Wm. F. Nye, New Bedford, Mass.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Walrath's Improved Portable Engines best in market; 3 to 8 H. P. Peter Walrath, Chittenango, N. Y.

For book on Lubricants, R. J.Chard, 134 M.Lane,N.Y.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel — other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

1,000 2d hand machines for sale. Send stamp for descriptive price list. Forsaith & Co., Manchester, N. H.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Wanted.—Second-hand Gun Stocking, and other Gun Machinery. Address V. A. King, Lock Box 81, New Haven, Conn.

For Power&Economy,Alcott's Turbine,Mt.Holly,N.J.

Notes & Queries

J. D.—You do not send sufficient data, but you can readily make the calculation for yourself, on the supposition that you will have to supply about 450 cubic feet of water per minute.—E. M.—We do not recommend special manufactures in these columns.—M. & Co.—Ashes will answer quite well.—J. S.—Consult Percy's "Refractory Materials and Fuel," and Svedelius' "Handbook for Charcoal Burners."—B. L. D.—Wrought iron weighs about 480 lbs. per cubic foot. From this you can make your calculations.—A. C. G.—See SCIENTIFIC AMERICAN, vol. 36, p. 203, and p. 155 (25), March 9, 1878.—A. L.—See SCIENTIFIC AMERICAN, November 10, 1877, p. 299 (3).—W. K. L.—See SCIENTIFIC AMERICAN, March 2, p. 139 (23).—A. S.—See SCIENTIFIC AMERICAN, March 16, 1878, p. 171.—W. H. A.—It would depend upon the system adopted, and the special circumstances of the case. You should refer the matter to an engineer.—J. R.—See SCIENTIFIC AMERICAN, pp. 33 and 225, vol. 33.—R. K. S.—See SCIENTIFIC AMERICAN, December 27, 1873. You will also find a good method described in Trautwine's "Engineer's Pocket Book."—C. H. M.—The perpetual motion machine described by you has been tried many times with numerous variations; and, it is unnecessary to add, with equal want of success. Consult Dircks' "Perpetuum Mobile."—J. G.—See description of leaching process in Percy's "Metallurgy."—P. P.—Address the inspector of your district. He will furnish information regarding qualifications necessary for obtaining a license.—M. & Co.—There have been many boilers set in the manner described, and operated successfully when the draught was not violently forced.—S. R.L.—See p. 698, SUPPLEMENT, October 28, 1876.—L. D.—See answer No. 45, p. 268, of SCIENTIFIC AMERICAN of October 27, 1877.—W. S.—There is a difference between the instrument described and that to which you refer.—F. W.—Sample of oil not received.—B. G. N.—See SCIENTIFIC AMERICAN of August 23, 1873.—C. R.—You will find a good summary of the art of tanning in the American Cyclopædia, and for fuller information you may consult Dussauce's "Treatise on Tanning."

(1) J. H. asks: 1. How may sulphuric acid be detected in vinegar? A. Add to a sample of the suspected vinegar a solution of barium chloride (in distilled or rain water); if a white precipitate forms, which does not redissolve on addition of strong nitric or hydrochloric acid, sulphuric acid is present. It is better to evaporate the sample of vinegar to be tested nearly to dryness in a clean porcelain dish, and to pour the concentrated fluid into a test tube partially filled with the solution of the barium salt. 2. How is the strength of vinegar commercially determined, and what is meant by "proof," "overproof," etc.? A. A sample of the vinegar is saturated, by agitation, with pure slaked lime, the clear liquor filtered off, and tested with an acetometer, an instrument resembling the hydrometer; sold with instructions by dealers in philosophical instruments. Proof vinegar contains 5 per cent of acetic acid, and will saturate 14½ grains of crystallized sodium carbonate.

What is the quicksilver alloy used on mirrors? A. An amalgam of mercury and tin.

(2) J. D. C. writes: I have a 5-cell Daniell battery for medical use. 1. Can the current be utilized for illuminating purposes, and how? A. Your battery is not of sufficient power to produce an electric light that would be of use for purposes of illumination. Use a battery of 50 Grove's cells. 2. Of what should the points for giving off light be made, so as not to be consumed too rapidly? A. Make carbon points of a ¼ inch square strip or pencil of gas retort carbon, which you may procure at the works where illuminating gas is manufactured.

(3) J. D. writes: I consume an immense amount of coal every crop at my sugar estate, nearly 800 tons, but at least one half the coal sold me is dust, which finds its way through the grate bars. 1. How could I burn the dust and not expose myself to such a loss? A. See p. 1295 of SUPPLEMENT, No. 82, vol. 4. 2. Which is the best and cheapest coal for producing steam? A. Anthracite nut coal is generally preferred if the boilers are large enough to supply abundant steam for the work to be done.

What is the weight of a gallon of cane juice at 10° density of Baumé? A. 10·28 (or $10\frac{7}{25}$) lbs. avoirdupois at 62° Fah.

(4) L. G. asks: Do the engines on the Pennsylvania Railroad fill their tanks while running, without stopping for water? They did in 1876; do they at present? A. The engines drawing some of the trains do.

(5) C. W. B. asks: Can an engine supply itself with air sufficient to run it by the use of leverage and by letting the exhaust air back into the air pump? How much surplus power can be obtained? The leverage may be any practical length from the engine to the air pump. A. As we understand your meaning, we think not.

(6) P. R. asks for a recipe for making a glue to be used on damp wood. A. 1. Hamelin's cement: Soak pure glue in water until it is soft; then dissolve it in the smallest possible amount of proof spirit by the aid of a gentle heat. In 2 ozs. of this mixture dissolve 10 grains of gum ammoniacum, and while still liquid add half a drachm of mastic dissolved in 3 drachms of rectified spirit. Stir well and keep the cement liquefied in a covered vessel over a hot water bath. It is essentially a solution of glue in mastic varnish. 2. Shellac, 4 ozs., borax, 1 oz.; boil in a little water until dissolved, and concentrate by heat to a paste.

(7) W. S. J. asks: What is the cause of color blindness, and is there any cure for it? I cannot see red apples on a tree at a little distance, the red and green looking just the same. A red light or red flag never attracts my notice, though a blue flag or light instantly does. I can see but three colors in the rainbow, and always call light brown or buff, green. If there is any remedy for the disease I should be glad to know it. A. Dr. Young, adopting apparently the notion of Darwin, that the retina is active, not passive, in vision, regarded it as the simplest explanation of this defect to suppose that those fibers of the retina which are calculated to perceive red are absent or paralyzed. The followers of Gall and Spurzheim maintain that the faculty of distinguishing colors does not depend on the eye, but on a particular part of the brain, to which they give the name of the organ of color, and that the defect lies in this organ and not in the eye. On whatever cause a partial or complete insensibility to color depends, it is a state of vision for which there seems to be slight means of cure. Consult McKenzie "On the Eye," and p. 368, vol. 35, SCIENTIFIC AMERICAN.

(8) J. H. B. writes: 1. I have a relay with two spools 1⅛ by 3⅛ inches. If I should unwind them and rewind the wire on spools 1¾ to 2 inches long, using all of the wire, would there be any difference in the sound? Would the short spools produce a heavier sound, or would they be the same as the longer ones? A. The difference in the sound produced by the alteration you mention would be slight. See answer No. 4, p. 155, SCIENTIFIC AMERICAN, March 9, 1878. 2. Would a relay with three or four spools produce a louder sound than one of two spools? A. That would depend on the relative resistance of the battery; and the wire used in the relay.

Please give me a recipe for a cheap varnish for brass steam throttles? A. Use a thin solution of shellac in alcohol.

(9) H. M. writes: I have a magnetic machine, intended for medical purposes, which I wish to adapt to making electrotypes. Will it answer? A. Your instrument produces an intense current of electricity, such as will produce physiological effects, as shocks, etc; electro-plating is best performed with a quantity current of low intensity. Although it is possible to produce an electrotype with the instrument, you would find it more convenient to use a battery.

Which is the front end of a steam engine? In books I find it always given as the end farthest from the crank, while in practice I invariably find it called the end through which the piston rod passes. A. This is simply a technicality, and depends somewhat on the style of engine. If you regard as correct the latter interpretation which you mention, it would not generally apply to locomotive engines.

(10) W. G. L. asks: How can I polish a cow's horn by hand? I wish to polish a handsome horn without using wheels or machinery of any kind. A. We think you can polish it by careful scraping with the edge of a piece of broken glass, and then rubbing it with some smooth, hard substance.

(11) C. B. desires instructions for making a lime kiln on a small scale, in which to burn oyster shells. Will some of our correspondents enlighten him?

(12) H. W. B. asks: 1. What size wire is best for connecting telephones? Will No. 40 insulated answer? A. No. 40 wire will answer for very short circuits, but it is easily broken; for house service use about No. 19 copper wire insulated with cotton, and soaked in paraffin. 2. How should connecting wire be put up from one room to another (in the same house) so as to be as little visible as possible? A. The wire may be laid in the recesses or grooves of the base board moulding, or tucked under the edge of the carpet.

(13) S. R. asks: 1. What is the rule for finding the capacity of air pumps for jet and surface condensers? A. Having fixed the length of stroke and number of revolutions of the pump per minute, divide twice the number of cubic feet to be removed per minute by the speed of the pump piston in feet per minute. The quotient will be the area of the piston. 2. What is the rule for finding the capacity of condensers for simple and compound engines? A. A common practice is to make the cooling surface from two thirds to three quarters the boiler heating surface. 3. What is the rule for finding the position of the piston in the cylinder, when the crank is at half stroke, for different strokes and different lengths of connecting rod? A. If c is the length of the connecting rod, and r the length of crank, the piston is at a distance from mid-stroke equal to $c - \sqrt{(c^2 - r^2)}$.

(14) W. T. H. asks: What horse power has an engine having a 6 x 9 inch cylinder, running 300 revolutions per minute, using 200 lbs. steam to the square inch, cut off half way? A. You might get between 40 and 45 effective horse power, if the engine is well designed and built.

(15) J. D. B. O. writes: Please give me a plan for a small fountain having a perpendicular jet, which will supply itself from the same water over and over again without mechanical force of any kind, something on the plan of the siphon. A. We doubt whether anything of the kind has been or ever will be designed.

(16) W. J. writes: Wishing to tin some ½ inch round iron hooks, I pickled them for 24 hours in a strong sulphuric acid and water mixture, without success in removing the scale. It costs too much to scour them by hand. What can be done? A. It is doubtful if you can clean them sufficiently without scouring. Mechanical scourers can be used, however.

(17) L. C. S. writes: I have a common tobacco press, and desire to know the amount of pressure I obtain by pushing 100 lbs. on the end of a 9 foot lever, the screw being 4 inches in diameter, with ¼ inch threads. A. Neglecting friction, the force applied is to the pressure produced, as the distance traveled where the pressure is applied is to the distance traveled by the force in the same time.

(18) L. A. W. asks: Can a spiral spring, made of good steel wire, be tempered so that it will retain its elasticity when subjected to constant hard usage? A. All spiral springs are apt to set in course of time. For mode of tempering, see SUPPLEMENT, Nos. 95 and 103.

(19) S. B. G. asks: Where did the river Jordan discharge its waters, before Sodom and Gomorrah were destroyed? A. The most generally accepted theory of travelers is that the Jordan always discharged into the Dead Sea, and that the "Cities of the Plain" were situated on the southern border of the sea. Some suppose that the Jordan at one time flowed into the Red Sea, and that its course was depressed into a deeper valley by a geological change.

(20) J. H. R. asks: Will it do to use the Bell telephone in circuit with the Morse telegraph? A. Yes; but if the magnet wire of the telephone is very fine and has great resistance, it should be connected so as to be in a partial or split circuit with the main line. See answer No. 19, p. 155, SCIENTIFIC AMERICAN of March 9, 1878.

(21) V. & G. write: Our grate bars are 16 inches below our boiler. Would we gain anything by raising them? We burn slack (soft) coal. A. No.

(22) C. S. M. writes: If I wish to ascertain the exact amount of rain which falls on a certain spot, say on a steep hillside, should the top of the gauge be horizontal, or should it incline as the hillside does? A. Horizontal, generally.

(23) J. F. W. writes: When a locomotive is drifting backward and you throw the reverse bar forward, it will fly back if not secured in the quadrant. Where does it get its leverage from? A. If the action occurs, it is due to the compression in the cylinders.

(24) F. S. L. writes: A vessel is going at a certain speed, and it is desired to double its speed. How much more power must be used? A. The exact ratio is not known. By the common rule it would take about 8 times the power.

(25) W. F. U. asks: If three men are to carry a 30 foot iron rail, where must the hand stick be placed so that each man will have an equal load, one man being placed at one end? A. 7½ feet from the other end, if the weight of the hand stick is disregarded.

(26) F. V. C. asks: Can a steamboat ascend as steep a grade as a locomotive drawing a train of cars, and what is the steepest practicable grade a steamboat can ascend and descend, the water being, say, 2 feet deep? A. The locomotive would have the advantage over the steamer. If you find the velocity of the water in the rapid to be 20 miles an hour, the speed of the boat, to be able to ascend, must be something more than this, and the practical limits are determined by the possible speed of the steamer.

(27) A. M. A. writes: One night I left a pail of water on a stone well box. The next morning I found it frozen over, and in the center was a spike of ice about 6 inches long and sharp at the top. What was the cause? A. Without knowing all the circumstances, we may not be able to explain the matter correctly, but we presume it was due to the expansion in freezing, if there were no outside interference. Perhaps other readers have observed similar phenomena on which they have reasoned. If so, we would be glad to hear from them.

(28) J. W. K. writes: We have a 3 horse power engine and boiler, fed from a tank which holds about five barrels, lined throughout with zinc, and made steam tight by soldering all joints. The tank has been in use 10 months. We use soft water from a tin roof painted with yellow ocher. The exhaust is blown directly into the tank at one end, and passes the length of the tank over the water, and what does not condense is carried off through a large tin conductor pipe 15 feet long, arranged so as to carry back all steam condensed before it reaches the outlet, thus using the water over several times. The water is nearly boiling hot when thrown into the boiler. An examination shows the zinc around the top of the tank and near the exhaust pipe to be badly corroded and crumbled. (Sample inclosed.) Will the water that has been in contact with this corroded zinc damage the boiler; and, if so, what will be the effect? A. We do not think the boiler will be injured by the zinc; but from the sample sent we are inclined to think that scale may be deposited in the boiler. It would be well to examine.

(29) W. B. asks: Does soda ash prevent scale from forming in boilers? Will it cause foaming? Is it injurious to the boiler? A. It has been recommended for preventing scale, and does not generally cause any inconvenience or injury.

(30) W. H. A. writes: A metallic pipe is standing vertically, supported so that the lower end is free from the ground. At the lower end is a valve which opens downward. The area of valve surface is 5 inches. Air is excluded from the pipe. What depth of water in the pipe will open the valve, the pipe being so long as to permit a vacuum to be formed above the water? A. The height of the column of water will be about 35 feet.

(31) F. B. S. asks: 1. Would it injure the steel in small tools to heat them red hot in a melting ladle or iron box in a common coal fire; that is, where the coal contains sulphur? Should the ladle or box be covered? A. It would be better to cover the tools with charcoal to prevent decarbonization. 2. How are small tools usually heated for hardening? A. In a charcoal or coal fire in which the gas is burnt out of the coal. The most recent practice for a quantity of tools is to heat in a flux of one half salt and one half potassium cyanide.

(32) P. M. asks: What is the difference in power between running a 60 saw cotton gin with 80 feet of shafting, and with a 42 foot belt from the engine pulley—with the proper shafting and pulleys in the two cases? A. As we understand the question, we do not think there will be much difference.

(33) J. F. W. writes: I have been firing a locomotive engine about a year, and never had any trouble in keeping steam up to the standard until within the last three months. The engine is cared for precisely as before, I use the same kind of coal, and I cannot see any difference in the way the fire burns. What is the difficulty? A. It may be caused by incrustations on the heating surfaces, which prevent the transmission of heat to the water to a considerable extent. From your account this seems probable.

© 1878 SCIENTIFIC AMERICAN, INC

(34) E. H. R. suggests that if J. D. B. (p. 155, current volume) should make his elevator pit of cast iron, the trouble about leakage would be ended.

(35) A. W. asks: How can green cherry lumber be seasoned without checking? A. If it is seasoned by immersion in water, the difficulty you speak of will probably be avoided. Some of the patented processes of seasoning may perhaps be applied to advantage.

(36) J. W. writes: Am I right in understanding that bearings should always be softer than the spindles which run in them? Is that only necessary in case of the oil being forced out? I use hardened steel spindles running in Babbitt boxes (woodworking machinery). As I use refined blacklead and oil as a lubricant, which does not answer so well with soft metals, I am desirous of employing iron or steel in future for bearings. What kind of iron or steel should I use for this purpose? A. The condition you lay down is by no means a necessary one. Cast iron makes a good bearing if plenty of surface is exposed to the pressure.

(37) J. S. S. writes: 1. I have a 10½ x 36 engine with a 10 foot fly wheel; boiler 3 feet diameter and 10 feet long, with 30 flues of 3 inches inside diameter. With this, how much Alabama pine ought I to saw in 10 hours? A. With a first class saw mill you might cut from 8,000 to 10,000 feet of inch boards if the logs are of good size. 2. How much corn ought I to grind in 10 hours with wood fuel, and 3½ oot Esopus stones? A. When the millstones are sharp you should grind from 12 to 15 bushels of corn per hour.

(38) G. S. writes: 1. I wish to put up some telegraph wire. Will common unannealed wire do, or will it have a tendency to act as a permanent magnet? A. It will do. We have not heard of its having a noticeable tendency to act in the way you mention. 2. Would not a 10 gallon jar, with zinc and copper to correspond, give as much electricity as 10 one gallon cells? A. It would be apt to give a greater quantity of electricity, but the tension of the electricity, or its ability to overcome resistance, would be nearly $\frac{1}{10}$ of the tension of electricity produced by the battery formed of 10 one gallon jars.

(39) T. C. wishes to stretch a 1 inch iron wire rope a distance of 400 feet, allowing but 10 feet sag in the middle, and carrying on the rope a weight of from 1,500 to 1,800 lbs. With these conditions he desires to know what will be the strain on the rope. A. According to Mr. Trautwine's tables, the strain = 5·03 ×(weight of rope+suspended weight).

(40) E. M. asks: What is the best material for a flat roof for a machine shop and foundry? A. Tin will answer very well. Corrugated iron and various patented materials are also frequently used.

(41) W. C. asks: 1. How are ocean cables repaired? A. The ends are hauled up and united. 2. Has a diver ever been to the bottom of the ocean? A. We are not aware of any diver having reached a depth of over 170 feet.

(42) C. E. S. asks: 1. In making an Æolian harp, what kind of strings is preferable catgut or wire? A. Ordinary violin or guitar strings answer very well. 2. How many strings are used? A. There is no particular limit to the number.

(43) M. J. C. writes: Please explain to me the difference between brace, stay, and gusset, and also what is meant by crow-foot? A. A brace supports parts in compression, and a stay, parts in tension. A gusset is an angle piece in a structure, used to stiffen it, and a crow-foot is a casting with three or more feet, used to secure from the outside, covers to holes that bear on the inside of a plate.

(44) H. N. L. asks: How much counterbalance must be put in a crank arm to make an engine run without vibration? A. The vibration cannot be prevented under all circumstances. You will find the principles of counterbalancing clearly laid down in Rankine's "Machinery and Millwork."

(45) T. W. W. asks: 1. Is it practicable to grind common oats into meal or flour suitable for bread on an ordinary country mill? A. They must first be kiln-dried. 2. What is the best dress for 30 inch granite stones, which are intended to grind wheat and corn? A. Furrows of moderate depth.

(46) St. C. asks: 1. What thickness of steel is necessary to resist a bullet fired from an army revolver? A. We think a plate from one eighth to three sixteenths inch thick will answer. 2. Which of the metals, steel or iron, presents the strongest resistance to leaden balls? A. Steel, generally. 3. Would a plate formed by riveting several sheets of steel together be stronger than a solid piece of the same thickness? A. No.

(47) W. T. W. asks: Is it possible to make a horizontal engine reversible using only one eccentric, and that a fixed one? A. Yes.

(48) C. B. asks: Who was the engineer in charge of the construction of the Hoosac tunnel? A. Thomas Doane.

What will prevent the falling out of hair from the head of a young person who is otherwise in perfect health? A. It is sometimes beneficial to cut the hair. Consult a physician.

(49) G. J. B. asks: What is the best way to soften thin portions of chilled castings, in order to drill them? A. Anneal them.

(50) F. B. asks for instructions for making a small steam launch. A. Take your pattern from a good rowboat, and put in just as large an engine and boiler as you can conveniently carry. See SUPPLEMENT, Nos. 69 and 81.

(51) J. S. writes: I have one of Landis' domestic steam engines, of 1½ horse power; upright boiler, 18 inches in diameter and 32 inches high, with 15 one-inch flues, full length of boiler. I am using about 60 lbs. of coal and 1 barrel of water per day of, say, 10 working hours. Can I economically substitute gas for coal, and if so, how should the gas be applied? A. We think that the coal would be so much more economical that its use is advisable, unless there is some other special reason for heating by gas. In case gas is used, some one of the patent heaters in the market might be applied to advantage.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. H. P.—The fragment contains a little copper blende, pyrites, and lead sulphide.—A. R. B.—It is a crystal of smoky quartz, the angles of which have been rounded by attrition.—D. N. LaB.—It is fine asbestos, of some value.—C. W. S. T.—No. 1. Clay containing much carbonaceous matter, iron, and alkaline earths, which renders it quite fusible. It may be used with other clays for earthenware, etc., and (pressed) for some decorative purposes. No. 2. Clay containing much sand. Tempered with other clay it might be employed in brickmaking. No. 3. Similar to No. 2. If washed it might perhaps be used by paper makers. No. 4. Clay slate. No. 5. An ocherous clay, suitable for a cheap pigment if burned and ground. No. 6. Sandstone. No. 7. It is a valuable copper ore—chalcopyrite, etc. Nos. 8 and 9 are chalcedony, of some value. No. 10 is barytes—sulphate of baryta—of good quality.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Telephonic Phenomena. By W. E. G.
A Brilliant Meteor. By G. W. S.
Snake Cannibalism. By H. R. H. and D. L.
Power Required for Velocipedes. By E. B. C. and G. F. S.
Nickel Plating. By W. H. F.
Darwinian Theory. By E. S. M.
Treatment of Inebriates. By T. P. P.
Perpetual Motion. By E. R. M.
Calculation of Horse Power. By T. J. L.
A Leech Barometer. By E. S. C.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 19, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Annunciator, electric, T. L. Reed 200,569
Axle box, A. A. Freeman 200,385
Axle box, J. Stephenson (r) 8,084, 8,085, 8,086, 8,087
Axle sleeve, J. Dickens 200,519
Bale tie, J. R. Blossom 200,428
Bale tie, J. J. Hagins (r) 8,094
Bale tie, W. E. Borst 200,371
Ballot box, M. D. Williams 200,495
Barrel, J. D. McEachren 200,468
Bed bottom, E. A. Jeffery 200,397
Bedstead, cabinet, J. G. & J. W. Knapp 200,401
Bedstead, invalid, J. Kaylor 200,543
Bee feeding device, E. Carter 200,506
Belting, W. H. Curtiss 200,517
Binder, H. E. Thompson, Jr 200,488
Bleacher and dyer squeezing machine, W. Birch 200,427
Book rack, A. R. Sherman 200,576
Boot and shoe heel plate, L. W. Buxton 200,505
Boot tree, J. T. Flynn 200,525
Bottle register, W. S. Lynn 200,552
Bottle stopper, L. Rose 200,409
Brick surfaces, wash for covering, Bartlett & Ward 200,498
Brush, T. J. Connell 200,434
Buckle, W. Bray, Jr 200,501
Buckle, A. E. McConnell 200,466
Burglar alarm, G. F. Busby 200,372
Butter pressing apparatus, J. Harlan 200,392
Button, E. W. McGlaulin 200,554
Cabinet, toilet, G. Rivera 200,480
Car coupling, M. R. Delay 200,438
Car coupling, D. R. Halter 200,451
Car draught and buffing apparatus, E. L. Caum (r) 8,095
Cars, driving gear for street, J. Bishop 200,499
Carbureter, W. H Reed 200,568
Carpet fastener, W. Aldrich 200,421
Carriage boot, Dodge & Brown 200,440
Carriage seat, shifting rail for, C. Fritschy 200,447
Cask washing machine, A. Muntzenberger *et al.* 200,470
Chair fan attachment, Thompson & Bergstrom 200,414
Chair, folding, C. D. Hyde 200,456
Chair, sewing machine, F. Chichester 200,508
Chair, window cleaning, A. Dormitzer 200,441
Chamber vessel, A. M. Rontey 200,481
Cheese cutter, J. N. Parker 200,472
Cheese manufacture, E. V. Lapham 200,547
Churn, B. B. Hess 200,531
Churn folding stand, J. McAnespey 200,403
Clock movement, A. E. Hotchkiss 200,534
Clock striking movement, Davies & Lambert 200,518
Clock striking movement, H. D. Northrop 200,564
Clutch mechanism, G. Crompton 200,375
Cock for steam boilers, stop, J. L. Heald 200,453
Cock, gauge, A. H. Jarecki 200,396
Coffee roaster, G. H. Downie 200,520
Collar, W. M. House 200,535
Cooker, feed, Cunningham, Winhofer & Rice 200,515
Cooking utensil, Shepard & Adams, Jr 200,575
Copy holder, J. D. Moore 200,560
Cord finishing machine, W. Buckton 200,503
Corset, C. A. Blohm 200,500
Corset, L. H. Foy 200,384
Corset manufacture, J. C. Tallman 200,583
Dam or dike, C. M. Scott 200,412
Dental plate, Fahnestock & Powell 200,445
Ditching machine, W. Smith 200,579
Egg case, J. L. & G. W. Stevens (r) 8,091
Elevator, hay, C. M. Mallory 200,465
Envelope, M. J. Duffee 200,442
Faucet, J. O. Waddell 200,416
Feather renovator, Sanders & Smith 200,411
Feed water regulator, C. Mendenhall 200,405
Fence, L. P. Judson (r) 8,096
Fence wire, C. F. Washburn 200,494
Fence wire stretcher, C. S. Davis 200,377
Fertilizer distributer, H. P. Underhill 200,490
Fire escape, G. W. Foster 200,526
Fire escape, W. B. Garoutte 200,387
Fire pot or portable furnace, J. W. Fisher 200,523
Foot rest, J. M. Shaw 200,483
Foot rest for hot air registers, J. Bonnet 200,429
Forge, Morrison, Mildren & Moore 200,562
Fruit drier, P. Riley 200,479
Furnace for heating links, J. H. Helm 200,394
Game apparatus, C. A. Roth 200,571
Garter, J. L. Moore 200,561
Gasoline burner, F. A. Lyman 200,464
Gate, F. J. Borgia 200,430
Gate, Cristy & Jay 200,514
Gate, J. E Johnston 200,398
Gate, W. G. Mentzer 200,555
Grain binder, M. A. Keller 200,544
Grain separator, J. S. Upton 200,585
Grater, S. Barker 200,423
Hame, J. M. Lasater 200,462
Harness, B. Jones 200,399
Harness attaching apparatus, M. H. M. Smith 200,486
Harvester, S. Hevener 200,532
Hat, E. Copleston 200,374
Heater, J. W. Hardwick 200,391
Hinge for moulders' flasks, A. Barker 200,422
Honey comb, artificial, A. B. Lawther 200,549
Horse detacher, N. Johnston 200,541
Horse power, W. W. Dingee 200,439
Horseshoe, H. J. Batchelder 200,425
Indexing books, J. Echols 200,381
Inkstand, H. G. Squires 200,581
Insect and vermin fumigator, F. Hanson 200,529
Insect exterminator, W. T. Daughtrey 200,376
Insect trap, Schreiber & Weigand 200,574
Ironing machine, T. S. Wiles 200,419
Ironing table, S. C. Terry 200,584
Journal for car axles, etc., H. Wakeman 200,492
Key, C. C. Coleman 200,512
Key fastener, R. McCully 200,404
Knife, C. Luetters 200,551
Knife scourer, S. K. Luce 200,550
Knitting machine, G. A. Leighton 200,463
Knob shanks, J. W. Haines 200,450
Ladder, J. W. Pine 200,475
Ladder, J. Flinn 200,524
Lamp, F. Carrier 200,373
Lamp chimney, E. R. Roswell 200,408
Lamps, globe for street, F. L. Senour 200,473
Lantern, T. B. Osborne 200,565
Leather boarding and graining, L. Townsend (r) 8,088
Life boat, G. F. Sievern 200,485
Life preserver, D. Ruge 200,572
Lighting apparatus, electric, J. King 200,545
Lock, C. C. Coleman 200,511
Loom, E. Howard 200,536
Lubricator, G. H. Flower 200,446
Lubricator for shafting, A. D. Hoffman 200,395
Meat, preserving, D. C. Link (r) 8,090
Mill, B. Whitney (r) 8,097, 8,098
Mill, C. C. Phillips 200,567
Mill spindle bush and tram, E. G. Cushing 200,436
Motion, reciprocating and rotary, E. Meredith 200,556
Motor, J. K. Cummings 200,516
Nut lock, J. & J. Collman, Jr 200,513
Oil saver and casing head, E. J. Northrup 200,471
Organ, H. F. Graetzel 200,528
Organ pipe, A. Gemunder 200,449
Overalls, H. F. Woodward (r) 8,093
Paddlewheel, L. Shook 200,577
Paddlewheel, W. C. Smalstig 200,578
Paging machine, E. Gorenflo 200,527
Paper pulp machine, W. W. D. Jeffers 200,540
Pen, drawing, R. L. Walter 200,588
Phonograph or speaking machine, T. A. Edison 200,521
Pillow, H. J. Buell 200,504
Pin, picket, P. J. Tweed 200,489
Picture exhibitor, J. C. Koch 200,460
Pitman connection, R. M. Lamson 200,461
Planter, H. Timmersmann 200,415
Planter, etc., R. B. Werner 200,590
Planter, L. J. Corbin (r) 8,089
Planter, check row attachment, E. W. Quincy 200,407
Plow, W. S. Moon 200,559
Plow, J. H. Riggan 200,478
Plow, H. F. & G. F. Shaw 200,413
Plow, R. C. Buckley 200,502
Plow and seeder, P. H. Elliott 200,444
Portfolio, J. D. Richards 200,477
Post marking and canceling, R. L. Grinnan 200,389
Press for fruits, etc., E. A. Stears 200,487
Press, seal, S. Larkin 200,548
Printing pills, machine for, W. R. Warner 200,589
Punching sheet metal tubing, E. O. Higgins 200,454
Rain gauge, Dunne & Richmond 200,443
Rake, W. M. White 200,592
Rolling metal, J. H. Swett 200,582
Ruling machine, J. McAdams 200,553
Saddle, J. R. Dempsy 200,378
Satchel handle, G. Havell 200,530
Saw mill, F. C. Frost 200,448
Sawing machine, C. H. Jones 200,542
Scales, A. B. Pearson 200,406
Scales, C. A. Fredericks 200,386
Screen, J. H. Cavanagh 200,433
Screw thread machine, Fairbairn & Simon 200,522
Seed cleaning machine, I. B. Sandusky 200,410
Sewer trap, J. Sargent 200,573
Sewing machine embroiderer, G. E. Hart 200,452
Sewing machine ruffler, G. W. Burgess 200,431
Shingle sawing machine, D. Lane 200,546
Shoe tip, E. F. Partridge 200,566
Signaling apparatus, D. H. Iseminger 200,457
Skate, E. H. Barney 200,424
Soldering device, F. B. Davis 200,437
Speaking tube, T. J. & G. O. Woolcocks 200,420
Spring, G. K. Smith 200,580
Spring, D. F. Cooper 200,435
Stamp, H. Wickham, Jr 200,418
Stave jointer, T. M. Chapman 200,507
Steam generator, W. S. Salisbury 200,482
Steamer, A W. Humphry 200,587
Stone sawing machine, H. Young 200,593, 200,594
Stove leg, H. H. Huntley 200,538
Stove oven shelf, C. N. Buzzell 200,432
Strainer for faucets, etc., A. H. Willoughby 200,496
Stuffing box, C. C. Jerome 200,458, 200,459
Tap with turnable outlets, C. G. Fischer 200,383
Target, E. B. Beer 200,426
Temperature, indicating, etc., E. Armstrong 200,497
Terret, C. L. Pond 200,476
Thermostat, W. B. Farrar 200,382
Thill coupling, D. D. Whitney 200,591
Tile laying machine, J. I. & W. J. Mettler 200,557
Tin from tin scrap, separating, P. C. Vogellus 200,587
Torpedo for oil wells, E. A. L. Roberts 200,570
Torpedo for oil wells, G. S. Vaughn 200,491
Toy money box, W. H. Lotz 200,402
Treadle, S. Haas 200,390
Truck, J. O. A. Bennett (r) 8,092
Tube expander and trimmer, J. E. Minshull 200,558
Tubing, armor for flexible, H. Wakeman 200,493
Twin hook, H. R. Cole 200,510
Valve, balanced rotary, J. S. Glenn 200,388
Vapor burner, F. H. Shepherd 200,484
Vat, C. Visel 200,586
Veneer cutting machine, J. D. McEachren 200,467
Vest of paper, etc., Weber & Kruse 200,417
Wagon gear and brake, J. J. Pennington 200,474
Washing machine, C. H. Horne 200,455
Washing machine, J. Metais 200,469
Watch case, O. Domon 200,379
Watch plate, Hutchinson & Dehouck 200,539
Watch and clock escapement, J. M. Hitchcock 200,533
Watch, stem winding and setting, O. Domon 200,380
Water closet disinfector, J. F. Naulty 200,563
Wells, steam heater for oil, J. Harris 200,393
Wheel, car, E. Kaselowsky 200,400
Wool washing machine, J. Clegg 200,509

English Patents Issued to Americans,

February 9 to February 21, inclusive.

Axle box.—G. A. Morse, South Egremont, Mass.
Glove fastener.—G. Havell, Newark, N. J.
Horseshoe.—J. Russell *et al.*, Newark, N. J.
Intrenching tool.—J. L. Buskett, St. Louis, Mo.
Lamp.—C. Chinnock, Brooklyn, N. Y.
Microscope object glass.—E. Gundlach *et al.*, Rochester, N. Y.
Mineral waters, etc.—G. D. Dows, Boston, Mass.
Mining machine.—F. M. Lechner, Columbus, O.
Oil stove.—E. B. Cox, Brooklyn, N. Y.
Railway brake.—A. K. Hadley *et al.*, New York city.
Refrigerator, J. Lorillard, New York city.
Revolver.—O. Jones, Philadelphia, Pa.
Rock drill.—A. H. Elliott, New York city.
Ship armor.—E. W. Serrell, New York city.
Steam and hydraulic press.—J. F. Taylor, Glenville, Conn.
Telephone.—G. B. Richmond, Lansing, Mich.
Telescope object glass.—E. Gundlach *et al.*, Rochester, N. Y.

CAVEATS, COPYRIGHTS, TRADE MARKS, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,

Publishers SCIENTIFIC AMERICAN,

37 Park Row, N. Y.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

© 1878 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion ---75 cents a line.
Back Page, each insertion ----$1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Founded by Mathew Carey, 1785.

BAIRD'S BOOKS FOR PRACTICAL MEN.

To our business of Industrial Publishers we have added that of Industrial Booksellers and Importers, and have now on hand a valuable stock of ENGLISH and AMERICAN PRACTICAL AND SCIENTIFIC BOOKS, including the most recent issues from the English and American press.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS—96 pages, 8vo—sent free to any one who will furnish his address.

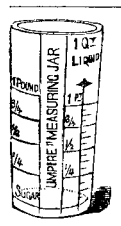
☞ A Select List of Books on Metals, Metallurgy, Strength of Materials, Chemical Analysis, etc.; also, one on Steam and the Steam Engine, as well as a Catalogue of a choice Collection of Practical, Scientific, and Economic Books, with prices, sent free upon application.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, Philadelphia.

BALL'S TELESCOPIC AND OTHER JACK SCREWS.

ALBERT BRIDGES, No. 46 Cortlandt St., New York.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.



THE UMPIRE MEASURING JAR.

An indispensable requisite in every kitchen and bakery for measuring, instead of weighing, sugar, flour, etc., and for liquids by the quart, pint, and fluid ounce.

Samples sent by express on receipt of 50 cts., or by mail, postpaid, on receipt of 90 cents.

Agents Wanted.

Address **UMPIRE GLASS CO.,**
RICHARD E. BREED,
100 Wood St., Pittsburgh, Pa.

National Fret-Sawing Association extends throughout U. S. and Canada. Supplies at first cost to members. Address, with stamp for prospectus, N. F. S. ASS'N, New England Office, Meriden, Ct.

MARK Your Linen with Clark's Indelible Pencils. Sold at all stationers'.

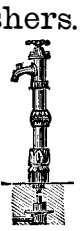
SALESMEN WANTED $125 A Month and Expenses selling to DEALERS SAMPLES FREE. Send 3c. STAMP to insure answer. S. FOSTER & CO. Cincinnati, O.

65 MIXED CARDS, with name, 10c. and stamp. Agent's Outfit, 10c L. C. COE & CO., Bristol, Ct.

BAILEY'S PATENT
Hydrants & Street Washers.

The best and cheapest in the market. Plumbers send for circular and prices to

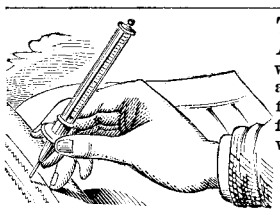
Bailey, Farrell & Co.,
Manufacturers of
Water, Gas & Steam Goods
PITTSBURG, PA.



RUPTURE BAND, $2.50. Worn night and day. Circular and measurement blank in plain sealed envelope on application.
L. F. LESDERNIER, 357 6th St., Brooklyn, N. Y.

HOLCOMB'S Improved Acoustic Patent Applied For. **TELEPHONE**

For short lines the best and cheapest Speaking Telephone manufactured. I have a test line of over 1 mile in length that transmits the voice with such power as to be heard distinctly in all parts of an ordinary room. Illustrated circulars for stamp. Address
J. R. HOLCOMB, Mallet Creek, Ohio.



THE ONLY Adding Pencil in the world. Does correct and rapid addition of figures. Price $1.00, free per mail. Agents wanted.

Adding Pencil Co.,
St. Louis, Mo.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

H. A. ROGERS,
19 John Street, N. Y.
MACHINISTS' SUPPLIES, Best and Cheapest, EVERYTHING IN THE LINE.

WORK FOR ALL

In their own localities, canvassing for the **Fireside Visitor,** (enlarged) Weekly and Monthly. **Largest Paper in the World,** with Mammoth Chromos Free Big Commissions to Agents. Terms and Outfit Free. Address **P. O. VICKERY Augusta, Maine.**

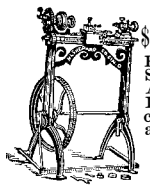
THE DRIVEN WELL.

Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent,** leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
NEW YORK.

SECOND-HAND ENGINES.

Portable and Stationary, at Low Prices.
HARRIS IRON WORKS, TITUSVILLE, PA.

$100 PER MONTH and EXPENSES or Commission to a few good men to sell our TEAS to DEALERS. NO PEDDLING. C. A. LONG & CO., Nos. 4 & 5 Fuller Block, Dearborn Street, Chicago, Ill. **YEARLY** Contract



SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scroll, Circular and Band Saws, Saw Attachments, Chucks, Mandrills, Twist Drills, Dogs, Calipers, ecc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 88, 90 & 92 Elm St., Cincinnati, Ohio.

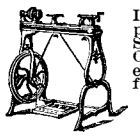
$2500 a year. Agents wanted everywhere. Business strictly legitimate. Particulars free Address J. WORTH & Co., St. Louis, Mo.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.
Send for Catalogue. DAVID W. POND, Successor to LUCIUS W. POND. **Worcester, Mass.**

$3 GOLD PLATED WATCHES. Cheapest in the known world. *Sample Watch Free to Agents.* Address, A. COULTER & Co., Chicago.

EAGLE FOOT LATHES,



Improvement in style. Reduction in prices April 20th. Small Engine Lathes, Slide Rests, Tools, etc. Also Scroll and Circular Saw Attachments, Hand Planers, etc. Send for Catalogue of outfits for Amateurs or Artisans.
WM. L. CHASE & CO.,
95 & 97 Liberty St., New York.

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

$1200 **Salary.** Salesmen wanted to sell our Staple Goods to dealers. No peddling. **Expenses** paid. Permanent employment. address S. A. GRANT & CO., 2, 4, 6 & 8 Home St., Cincinnati, O.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading **Mining, Manufacturing,** and **Railroad** corporations in the **United States** and **Foreign Countries. First Premium** wherever exhibited, and hundreds of testimonials of the *highest character.*
A NEW SIZE FOR PROSPECTING AND LABORATORY USE.
☞ ALL STONE CRUSHERS not made or licensed by us, containing vibratory convergent jaws actuated by a revolving shaft and fly-wheel, are infringements on our patent, and makers and users of such will be held accountable. Address
BLAKE CRUSHER CO., New Haven, Conn.

VANDERBURGH, WELLS & CO., 18 Dutch St., cor. Fulton, N. Y. ENGRAVERS' BOX-WOOD, MACHINISTS' PATTERNS & BRAND LETTERS.

WROUGHT IRON BEAMS & GIRDERS

THE UNION IRON MILLS, Pittsburgh, Pa., Manufacturers of improved wrought iron Beams and Girders (patented).

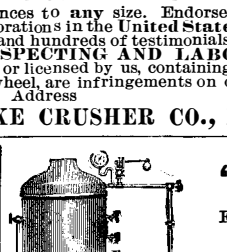
The great fall which has taken place in the prices of Iron, and especially in Beams used in the construction of FIRE PROOF BUILDINGS, induces us to call the special attention of Engineers, Architects, and Builders to the undoubted advantages of now erecting Fire Proof structures; and by reference to pages 52 & 54 of our Book of Sections—which will be sent on application to those contemplating the erection of fire proof buildings—THE COST CAN BE ACCURATELY CALCULATED, the cost of Insurance avoided, and the serious losses and interruption to business caused by fire; these and like considerations fully justify any additional first cost. It is believed, that, were owners fully aware of the small difference which now exists between the use of Wood and Iron, in many cases the latter would be adopted. We shall be pleased to furnish estimates for all the Beams complete, for any specific structure, so that the difference in cost may at once be ascertained. Address
CARNEGIE, BROS. & CO., Pittsburgh, Pa.

RUBBER TYPE!

Cases of 125 movable letters, etc., with printing apparatus, $1.50 by mail; sample of Type and circular, 6c. Address RUBBER TYPE CO., Mallet Creek, Ohio.

Steel Name Stamps.

N. Y. STENCIL WORKS, 87 Nassau St., N. Y.



SNYDER'S "Little Giant" STEAM ENGINE.

For Farmers, Machinists, Printers, and all requiring Light Power.

Sizes from One to Six H. P. Prices for Engine and Boiler complete, from $150 to $450. We make the *Strongest Boiler* and the *Best Engine* in the country. Call at our Factory and examine, or send for free Illustrated and Descriptive Catalogue.
SNYDER BROS., 94 Fulton St., New York.

50 Best Mixed Cards, with name, in case, 13c., or 25 no 2 alike, 10c. Outfit 10c. Dowd & Co., Bristol, Ct.

THE SCIENCE of LIFE,
OR, SELF-PRESERVATION.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive steel plate engravings, and more than 50 valuable prescriptions for all forms of prevailing diseases, the result of many years of extensive and successful practice. 300 pages, bound in French cloth; price only $1, sent by mail. The London Lancet says: "No person should be without this valuable book. The author is a noble benefactor." An illustrated sample sent to all on receipt of 6 cents for postage. Address DR. W. H. PARKER, 4 Bulfinch St., Boston. The author may be consulted on all diseases requiring skill and experience.

MUSIC.

Send to BOOSEY'S, 32 East 14th Street, New York, for catalogue of their music. Cheaper than the cheapest.

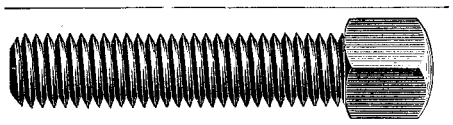
Special Offer!

LEISURE HOURS is the name of a handsome 16 page family literary paper, (size of Harper's Weekly,) filled with the best stories, sketches, poetry, etc., written by the ablest authors. In publishing a paper designed to fill a place, and win a welcome in American homes, we are not unmindful of the tacit obligation resting upon us to furnish reading matter, good as well as varied in its character, safe as well as interesting: while some of its contents are strictly moral, none are coarse or sensational, and all are entertaining, all carefully chosen, both to form and to satisfy a correct taste. That every reader of this notice may be induced to send for a three months' trial of **LEISURE HOURS,** the publishers, J. L. Patten & Co., 162 William St., New York, offer to send the paper **three months,** (commencing with the charming story entitled "Holden with the Cords,") for fifteen cents (stamps taken): and also to give every one a pair of beautiful Easter Cross Chromos, all postpaid. **All who send for this 3 months' subscription are guaranteed double value of money sent.** Every subscriber receives a handsome illustrated catalogue, with prices of 1,000 articles, which every person needs, for amusement, recreation and home adornment. $1,500 in prizes given free to agents. Newsdealers sell **LEISURE HOURS,** price seven cents. State where you saw this advertisement.

SCROLL SAWS, Fleetwood, Dexter, Lester, Centennial, etc., *at Factory Prices.* Wood & Designs. **LATHES** with Jig & Circular Saw Attachments. **TOOLS & HARDWARE** for Amateurs, *Machinists, Carpenters,* and every Department of Mechanical Trade. Send stamp for Catalogue, and state *what kind* of Tools or Machines you require.
TALLMAN & McFADDEN, 607 Market St., Philad'a.

MAGIC BUTTON-HOLE BOUQUET.

Pat. May 1st, 1877.
Buds and *Bloo s* at leasure. A *pretty, ingenious,* and *amusing* little *Mechan cal Novelty.* Sample 25 cents.
N. & A. POTTS, 6 N. Front St., Philadelphia, Pa.

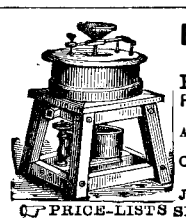


EVERY DESCRIPTION OF STEEL, IRON, and Brass Screws for Machinery. Send for new catalogue. L. F. STANDISH & CO.,
26 Artisan Street, New Haven, Ct.

STEEL NAME STAMPS 15 CTS. PER LETTER, POST paid. STEEL STAMP WORKS, New Haven, Conn.

PATENT MINERAL WOOL.

Incombustible. The best non-conductor. For illustrated description see SCIENTIFIC AMERICAN of January 12th.
A. D. ELBERS,
P. O. Box 4461. 26½ Broadway, N. Y.



BRADFORD MILL CO,

Successors to Jas. Bradford & Co.
MANUFACTURERS OF
French Buhr Millstones, Portable Corn & Flour Mills, Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishing.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J. R. Stewart, *Pres.* W. R. Dunlap, *Sec.*
☞ PRICE-LISTS SENT ON APPLICATION.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 414 Water St., N. Y., who control the patent for Green's American Driven Well.

BIG PAY to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

WANTED—Men in each State for the Detective Service and to report crime. Pay liberal. Inclose stamp, and address AMERICAN AND EUROPEAN SECRET SERVICE CO., Cincinnati, Ohio.

RAPID
ADDITION.
Wonderful Invention.

Art of Adding Figures from left to right; or from middle either way; or Six Columns at one time! Done as quick as Thought! Sent to any address on receipt of price, 50 cents.
WILLIAM FURNISS,
Batavia, Genesee Co., N. Y.

THE DINGEE & CONARD CO'S BEAUTIFUL EVER-BLOOMING ROSES

We deliver **Strong Pot Roses,** *suitable for immediate flowering,* safely by mail, at all post-offices. **5 Splendid Varieties,** *your choice,* all labeled, for **$1; 12 for $2; 19 for $3; 26 for $4; 35 for $5; 75 for $10; 100 for $13.** Send for our **NEW GUIDE TO ROSE CULTURE,** and choose from over **500** finest sorts. Our **Great Specialty** *is growing and distributing Roses.* THE DINGEE & CONARD CO., *Rose-Growers,* West Grove, Chester Co., Pa.

STEAM PUMPS.

FIRST PRIZES, CENTENNIAL, PHILA., VIENNA, PARIS, NEW YORK, BALTIMORE, BOSTON.
Send for circular of recent patented improvements.
THE NORWALK IRON WORKS CO.,
Prices Reduced. South Norwalk, Conn

METAL, PAPER, OR LEATHER
PERFORATING DIES.

E. B. STIMPSON, 31 SPRUCE ST., N. Y.

The Aneroid Barometer,
ITS CONSTRUCTION AND USE.

Compiled from various sources. Being No. 35 Van Nostrand's Science Series. 18mo. Boards, 50 cents; Full Roan, $1.

D. VAN NOSTRAND, Publisher,
No. 23 Murray St. and 27 Warren St., N. Y.
**** Copies sent free by mail on receipt of price.

Small Tools of all kinds; also GEAR WHEELS, parts of MODELS, and materials of all kinds. Castings of Small Lathes, Engines, Slide Rests, etc. Catalogues free. GOODNOW & WIGHTMAN, 23 Cornhill, Boston, Mass.

IRON WORKING TOOLS.

Owing to the recent further break in prices, which must soon advance, we can to-day make extraordinarily low figures on lathes, planes, etc., of the best makers.
HILL, CLARKE & CO., Machinery, Boston, Mass.

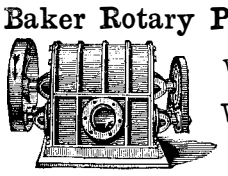
RISDON'S IMPROVED
TURBINE WATER WHEEL

Yielded at the test of Turbines at Centennial Exposition the best results at all stages of gate. Send for circular to
T. H. RISDON & CO.,
Mt. Holly, N. J.
Manufacturers of MILL MACHINERY.

2d Hand Punch and Steam Hammer.

One large Shear and Punch. Will cut 1½ in. iron. One Dudgeon double column Steam Hammer, 8 in.
HILL, CLARKE & CO., Boston, Mass.

Baker Rotary Pressure Blower.



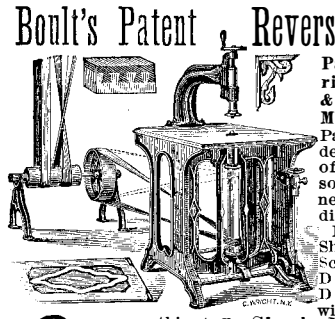
(FORCED BLAST)
Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

DANBURY DRILL CHUCKS. Perfected and Price reduced. Manuf'd by the HULL & BELDEN CO., Danbury, Ct.

OTIS' SAFETY HOISTING Machinery.

OTIS BROS. & CO., No. 348 Broadway, New York.

Boult's Patent Reverse Motion



Paneling, Variety Moulding & Dovetailing Machine. Cuts Panels of any design or style of mould in the solid wood with neatness and dispatch.

Is a first-class Shaper, Edge, & Scroll Moulder. Does general Dovetailing with thick or thin stuffs. **Simple, Durable and Efficient.** ☞ Send for Pamphlet and Sample of work. Improved Solid Steel Cutters for all kinds of Variety Moulders made to order, and warranted by the

B. C. MACHINERY CO.,
Battle Creek, Mich.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

OUR FRESH STOCK OF
WHITE HOLLY

IS NOW READY.
This, with our complete assortment of
RARE & FANCY WOODS,

embracing some 30 varieties, is particularly worthy the attention of Wholesale Buyers.
Send for Price List.
GEO. W. READ & CO.,
186 to 200 Lewis Street, N. Y.

JENNINGS' WATER CLOSETS

PRICES REDUCED SEND FOR CIRCULAR
94 BEEKMAN STREET NEW YORK

PARIS EXPOSITION.

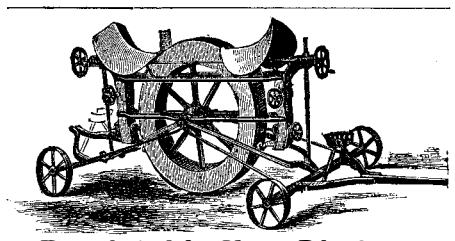
The undersigned, American Bankers and Commission Agents in Paris for twenty-five years, offer their services to exhibitors for representation and negotiations.
JAMES W. TUCKER & CO., 3 and 5 Rue Scribe.

© 1878 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

ALCOTT LATHES, for Broom, Rake and Hoe Handles. S. C. HILLS, 78 Chambers St. N. Y.



Randolph's New Ditcher.
Reversible, Double Ender. Doing work of sixty men, by horse power, at cost of six! Steam Machines, costing less than $10 per day to run, doing from $100 to $140 work. Circulars from RANDOLPH BROS., 111 Broadway, New York.

SILVER, Gold, Metals, Gems, Minerals, and where to look for them, described in the Pocket Geologist, price 50c., by F. H. Smith, 13 German St., Baltimore, Md.

Jarvis Gas Consuming Furnace.
For Setting Steam Boilers. Will burn screenings with small mixture of soft coal without blower, also *green wet peat*. Three boilers set this way will make as much steam as five old way. Address A. F. UPTON, Agent, Boston, Mass.

Steel Castings,

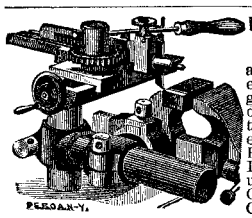
From ¼ to 10,000 lbs. weight, true to pattern. An invaluable substitute for forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, EVELINA STREET, PHILADELPHIA, PA.

H. R. WORTHINGTON,
239 BROADWAY, NEW YORK.
Hydraulic Works, Van Brunt Street, Brooklyn, Manufactures Pumping Engines for Water Works. In daily use at 100 stations. Also Steam Pumps, Water Motors and Water Meters. See SCIENTIFIC AMERICAN SUPPLEMENT, January 27th, 1877. Prices largely reduced July 1st, 1877.

VERTICAL SCIENTIFIC GRAIN Mills and Black Diamond Mill Picks are our specialties. Before purchasing elsewhere send for price list.
A. W. STRAUB & CO.,
2231 Wood St., Philadelphia, Pa.

PORTLAND CEMENT,
ROMAN & KEENE'S. For Walks, Cisterns. Foundations, Stables, Cellars, Bridges, Reservoirs, Breweries, etc. Remit 10 cents for Practical Treatise on Cements.
S. L. MERCHANT & Co., 76 South St., New York.

PHOTOGRAPHY MADE EASY
By the use of
The American Optical Co.'s Pocket Cameras,
AND
NEWTON'S EMULSION for DRY PLATES.
Send for the March Number of
"THE PHOTOGRAPHIC TIMES,"
Which contains Full Instructions.
SCOVILL MANUFACTURING CO., Publishers,
419 & 421 Broome Street, New York.



Universal Hand Planer, Judson's Patent.
Model makers, jewelers, and metal workers generally, find this tool of great value. Prices reduced. Send for illustrated catalogue of Planers, Iron Cutters, Shears, Punches, Universal Ratchet Drills, &c. Manufactured exclusively by OLD COLONY RIVET CO., Kingston, Mass.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

Patent Wood-working Machinery, Band Saws, Scroll Saws, Friezers, etc. Cordesman, Egan & Co., Cincin'ti, O.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector**, capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.
J.E. BUERK, P.O. Box 979, Boston, Mass
N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. A fine was assessed against them Nov. 11, 1876, for selling contrary to the order of the court. Persons buying or using clocks infringing on my patent will be dealt with according to law.

THE Most practical work on Gardening yet published. Contains a list of upward of 2,500 varieties of **Garden, Field, and Flower Seeds**, with explicit directions for culture, and much other useful matter. Mailed, postpaid, upon receipt of 35 cents.
Bliss' Illustrated Potato Catalogue contains a list of 500 varieties, with description of those recently introduced, with many other desirable sorts, beautifully illustrated. Also useful information upon the cultivation and chemistry of this valuable esculent. 10c.
Bliss' Illustrated Handbook, for the Farm and the Garden, and abridged Catalogue of **Garden, Field, and Flower Seeds, Fertilizers**, Agricultural Implements, etc., etc. One hundred pages, many illustrations, 3 cents.
Bliss' Illustrated Catalogue of Plants, for the Greenhouse, Conservatory, Lawn & Flower Garden, free.
B. K. BLISS & SONS,
P. O. Box, 5712. 34 Barclay St., New York.

Harrison's System of Grinding!
Illustrated Catalogue Now Ready.
NEW STANDARD FLOURING MILLS.
Old Theories, Horizontal Grinders, Slow Runners, Fully Exploded. Fine Flour, High Speed, and Economical Milling Fully Established.
A NEW Copy For All.
Millers and Editors please address
EDWARD HARRISON,
No. 135 Howard Ave. New Haven, Conn.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

PUNCHING PRESSES. Drop Hammers and Dies, for working Metals, &c. THE STILES & PARKER PRESS CO., Middletown, Conn.

The HOADLEY PORTABLE STEAM ENGINE.
WITH AUTOMATICAL CUT-OFF REGULATOR AND BALANCED VALVE.
THE BEST & MOST ECONOMICAL ENGINE MADE.
SEND FOR CIRCULAR.
The J.C. HOADLEY CO. LAWRENCE, MASS.
STATE WHERE YOU SAW THIS.

Cut Brass Gears, list free. Grant, 194 Beverly St., Boston.

ROCK DRILLING MACHINES AND AIR COMPRESSORS.
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG, MASS.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

PATENTS AT AUCTION.
Regular Monthly Sales the first week of each month by George W. Keeler, Auctioneer, at his salesrooms, 53 Liberty Street, N. Y. For terms, etc., address The New York Patent Exchange, Room 11, 55 Liberty Street.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, &c.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

25 EXTRA NEW YEAR CARDS, with name, 20 cts. Samples 3c. J. B. HUSTED, Nassau, N. Y.

P. BLAISDELL & CO.,
Worcester, Mass.,
Manufacturers of the Blaisdell Patent Upright Drills and other first-class Machinists' Tools.

FRIEDMANN'S PATENT
INJECTORS and EJECTORS
Are the Most Reliable and Economical
BOILER FEEDERS
And Water Conveyors
IN EXISTENCE.
MANUFACTURED EXCLUSIVELY BY
NATHAN & DREYFUS,
NEW YORK.
Also Patent Oilers and Lubricators.
Send for Catalogue.

WATSON'S NON CHANGEABLE GAP LATHE HAS GREAT FACILITIES FOR LARGE OR MEDIUM SIZE WORK. JAMES WATSON MANF'R 1608 S. FRONT ST. PHILA. PA.

CAMERON Steam Pumps
For Mines, Blast Furnaces, Rolling Mills, Oil Refineries, Boiler Feeders, &c.
For Illustrated Catalogue and *Reduced* Price List send to **Works, Foot East 23d St., New York.**

PORTABLE QUARTZ MILL.
(Hammond's Patent Cam.)
MILL, HORSE-POWER, AND PAN COMPLETE.
The above is a cheap, first-class, complete
GOLD AND SILVER MILL
that can be taken to any place where a man can walk, and then be made to run out bullion by hand or horse power. Mills and rights of territories for sale. Apply to CULVER & CO., Calistoga, Napa Co., California.

ESTABLISHED 1844.
JOSEPH C. TODD,
(Formerly of Todd & Rafferty), ENGINEER and MACHINIST. Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. I also manufacture Baxter's New Portable Engine of 1877, of one horse power, complete for $125; can be seen in operation at my store. I will furnish specifications and estimates for all kinds of machinery. Send for descriptive circular and price. Address
J. C. TODD,
10 Barclay St., New York, or Paterson, N. J.

☞ **We have just added a new feature to our establishment in the shape of**
ARTIFICIAL LIGHT.
By its use we can work in any kind of weather, and can push hurried work through at night. ☜

NEW METHOD OF ENGRAVING
Moss' Process.
Photo Engraving Co.
67 Park Place, New York.

L. SMITH HOBART, President. JOHN C. MOSS, Superintendent.

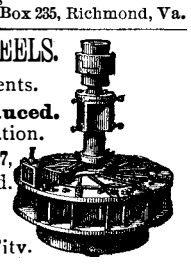
RELIEF PLATES
For Newspaper, Book and Catalogue Illustrations, Engraved in Type-metal, by a new Photo-Chemical Method, from all kinds of Prints, Pen Drawings, Original Designs, Photographs, &c., much cheaper than Wood-cuts. These plates have a perfectly smooth printing surface, and the lines are as deep, as even, and as sharp as they could possibly be cut by hand. We guarantee that they will print satisfactorily on wet or dry paper, and on any press where type or wood-cuts can be so printed. Electrotypes may be made from them in the usual way.
Our Plates are now used by the principal publishers and manufacturers in every State in the Union.
SEND STAMP FOR ILLUSTRATED CIRCULAR. **Please say where you saw this.**

ICE AT $1.00 PER TON.
The PICTET ARTIFICIAL ICE CO.,
LIMITED,
Room 51, Coal and Iron Exchange, P. O. Box 3083, N. Y.

WOOD ENGRAVING
At the same prices as any of the Photo-Engraving Processes. T. P. DONALDSON, 31 Park Row.

FURNITURE FACTORY FOR SALE AT Richmond, Va. All the requisite Modern Machinery; also, unfinished stock and Lumber on hand, together with a well located Saw Mill. Purchaser can rent or lease Factory building. Address
GARRET F. WATSON, P. O. Box 235, Richmond, Va.

LEFFEL WATER WHEELS.
With recent improvements.
Prices Greatly Reduced.
7000 in successful operation.
FINE NEW PAMPHLET FOR 1877, Sent free to those interested.
James Leffel & Co,
Springfield, O.
109 Liberty St., N. Y. City.



SPECTACLES AT REDUCED PRICES. Microscopes, Opera Glasses, Telescopes, Thermometers. Send for Illustrated Catalogue. **R. & J. BECK,**
921 Chestnut St., Philadelphia.

NEW UNITED STATES GOVERNMENT Rules in Respect to Boilers, Boiler Inspection, Stamping and Testing of Boiler Plates, Fire Apparatus, and Boat Lowering Devices and Life Preservers. Instructions to Inspectors, and Tests of Boiler Material are to be made and recorded. Requirements in Construction of Boilers. The Law in full, with List of Approved Fire Extinguishing, Life Saving, and Boat-lowering Apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **113.** Price 10 cents. To be had at this office and of all newsdealers.

TO ADVERTISERS! We will send free to all applicants who do any newspaper advertising, the THIRD EDITION of
AYER & SON'S MANUAL
FOR ADVERTISERS. 160 8vo. pp. More complete than any which have preceded it. Gives the names, circulation, and advertising rates of several thousand newspapers in the United States and Canada, and contains more information of value to an advertiser than can be found in any other publication. All lists have been carefully revised, and where practicable prices have been reduced. The special offers are numerous and unusually advantageous. Be sure to send for it before spending any money in newspaper advertising. Address **N. W. AYER & SON,** ADVERTISING AGENTS, Times Building, Philadelphia.

25 NEW YEAR CARDS, with name, 20c. **25** Extra Mixed, 10c. Geo. I. Reed & Co., Nassau, N. Y.

$1 for 10 cts.! Truly a fact that *many* jobs of printing can be done with an Excelsior Portable Press for 10c. *on a dollar of printers' prices.* Card and Label Press, $3. Illustrated catalogue of all sizes mailed for 6c.
KELSEY & CO., M'f'rs, Meriden, Conn.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
GEO. PLACE, 121 Chambers St., New York Agent.

H. W. JOHNS' PATENT.
ASBESTOS MATERIALS.
Liquid Paints—all shades, finest in the world.
Fire Proof Paint, for Wood work, &c.
Roof Paint, for Tin Roofs, Iron Work, &c.
Roofing, with white Fire Proof Coating.
Roof Coating, for restoring and preserving old roofs.
Cements, for Retorts, Furnaces, Leaky Roofs, &c.
Steam Pipe and Boiler Coverings.
Steam Packing, Asbestos Boards, Fire Proof Coatings, Sheathings and Roofing Felts, &c.
These articles are ready for use, and can be easily applied by any one. Send for Samples, Pamphlets, Price Lists, &c.
H. W. JOHNS MANUFACTURING COMPANY,
87 Maiden Lane, New York.
Also for sale by PHILADELPHIA BRANCH, 406 Arch St.; DOWNIE, TRAINER & CO., Boston; S. W. HEMPSTED & CO., Columbus, Ohio; M. M. BUCK & CO., St. Louis; C. A. PARKER & CO., New Orleans; THOMPSON & UPSON, San Francisco.

ADVERTISERS SELDOM FAIL TO MAKE MONEY
When their advertising is properly placed.
For list of best mediums, address
EDWIN ALDEN'S ADVERTISING AGENCY,
174 ELM STREET, CINCINNATI, O.
☞ *Best rates in the best papers.* ☜
Send for catalogue. Estimates and information free.

PATENTS SOLD.
For terms, address EUROPEAN and UNITED STATES PATENT EXCHANGE, 200 Broadway, N. Y. Box 2801.

PATENT COLD ROLLED SHAFTING.
The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use, renders it undoubtedly the most economical We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburgh, Pa.
190 S. Canal Street, Chicago, Ill., and Milwaukie, Wis.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
GEO. PLACE & CO., 121 Chambers St., N. Y.

STEAM PUMPS.
"Isochronal" and **"Positive,"** New Valve Motions, for Cities, Towns Mines, Mills, Factories, Breweries, Distilleries, Hotels, Elevators, Steamboats, R. R. Stations. Contractors, and Steam Boiler Uses. Cope & Maxwell M'f'g Co., Hamilton, O. Reduced Price List furnished.

MACHINISTS' TOOLS
Best quality at low prices. Radial Drills, Engine Lathes, Iron Planers, Car Wheel Borers, Hydrostatic Presses, Axle Lathes.
NILES TOOL WORKS, Hamilton, Ohio.

THE
Scientific American.
The Most Popular Scientific Paper in the World.
THIRTY-THIRD YEAR.

Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

The Postal Union.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 59 Gold St., New York.

© 1878 SCIENTIFIC AMERICAN, INC